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REMOTE STORAGE





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Vol. 31, January—December, 1919

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(PUBLISHED MONTHLY)

William Seafert, *Publisher and Editor*

J. F. Waldron, *Advertising Manager*

R. M. McCully, *Business Manager*

Office—672 Transportation Building, Chicago

Telephone, Harrison 5397

Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, \$1.00 per year; all
other countries, \$1.50 per year.
Single Copies 20c.

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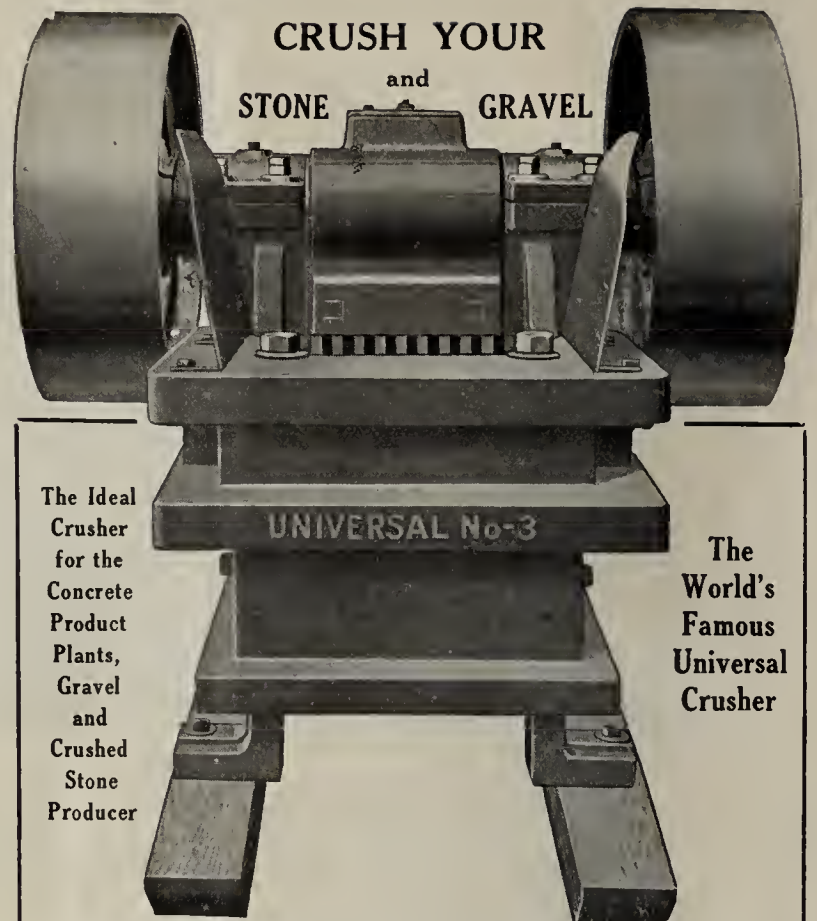
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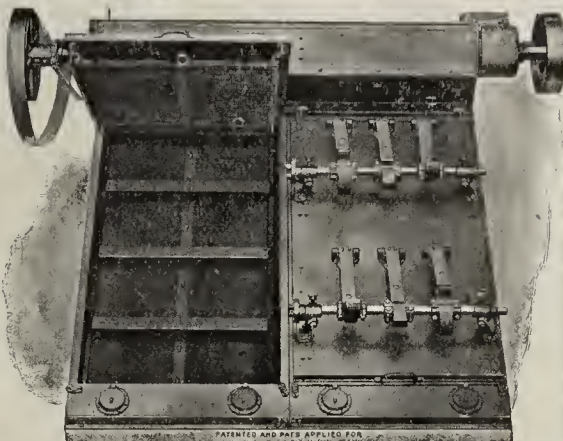
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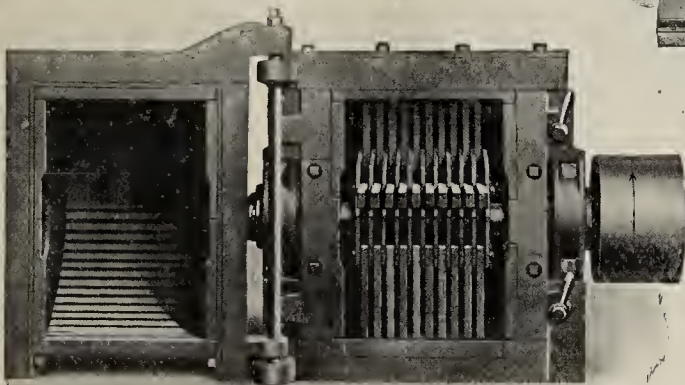


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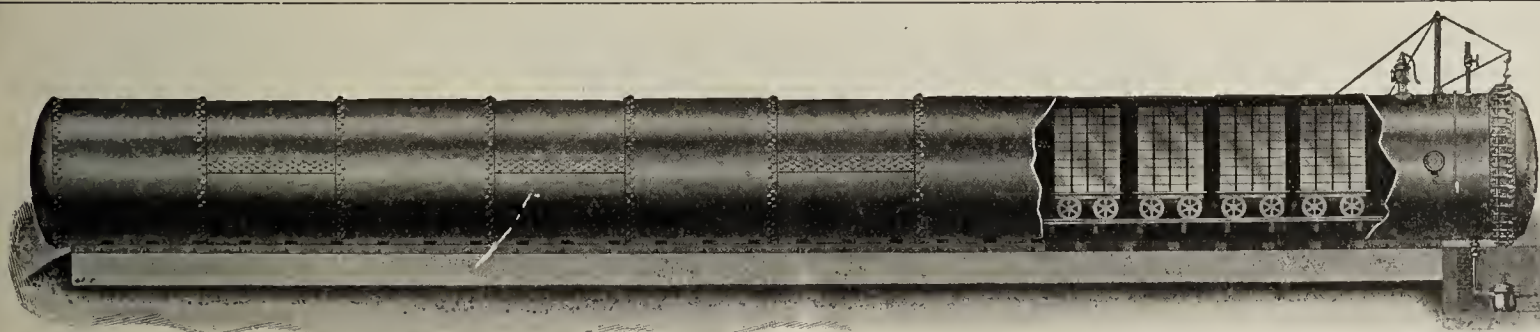
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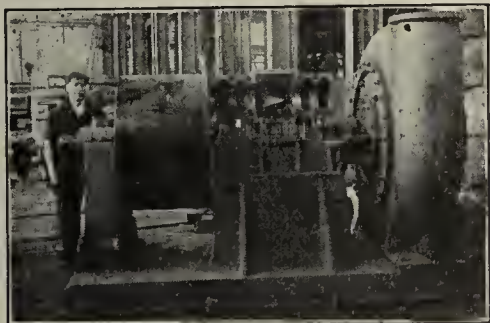
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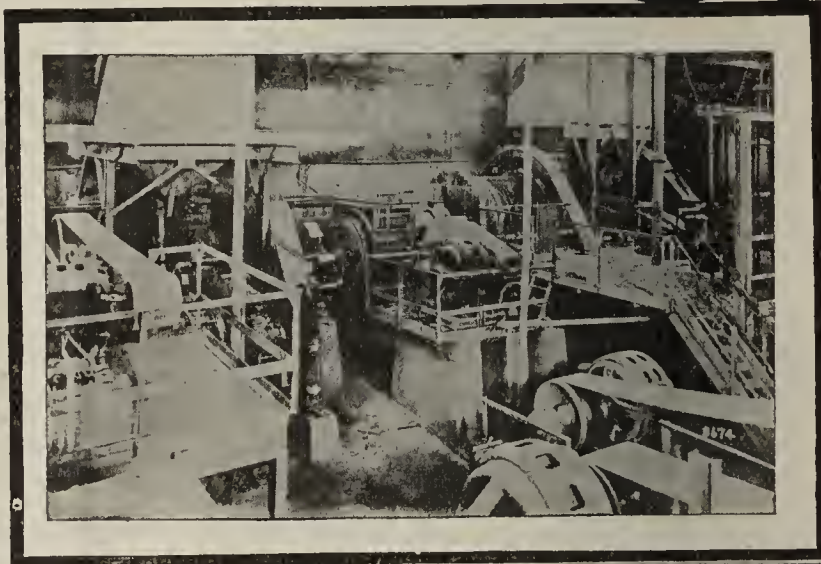
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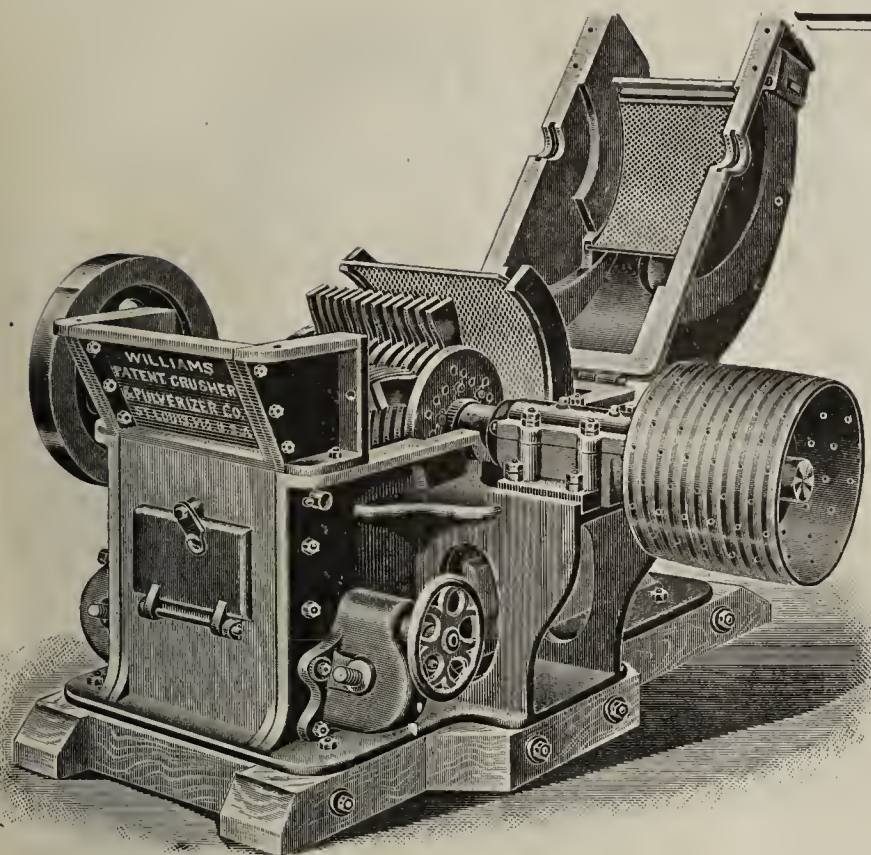
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Take 2 in. to 3 in. dry stone and in one operation, without outside screens or separators will produce 95% through 20-mesh material.

**CAPACITIES RANGE FROM
1/4 TO 30 TONS PER HOUR**

**Over 5,000 Williams Mills in Daily
Operation.**



There is undoubtedly room in your plant for one of these machines, which, in the last twenty-two years have proven that they are money savers, can be depended on, and really have merit. If further information is desired, Write for Bulletin No. 17, which is brim full.

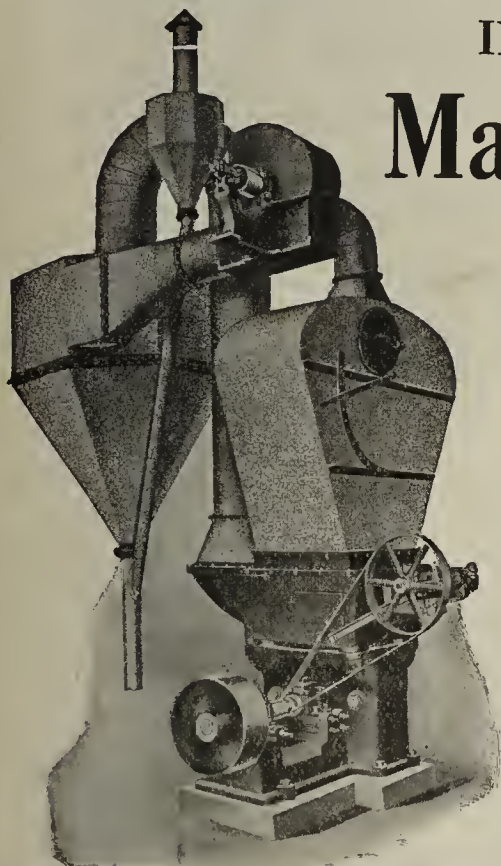
THE WILLIAMS PATENT CRUSHER & PULVERIZER COMPANY

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Complete Grinding IN ONE Machine



In successful use
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Cement, Clinker,
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**INSTANT
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NO DUST

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**A superior, colorless,
Liquid Cement Hardener**

GRANOLITHIC makes cement floors
Wear Proof—Dust Proof and Water Proof.
The dust that is so injurious to merchandise,
machine bearings and motors is eliminated.
The cost of treating cement with GRANOLITHIC
is trifling compared to the economies effected.
Unsolicited testimonials tell the story. Write
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**LIQUID
CEMENT
FLOOR HARDENER**



This belt is built to meet just such wearing conditions as you have in your cement plant

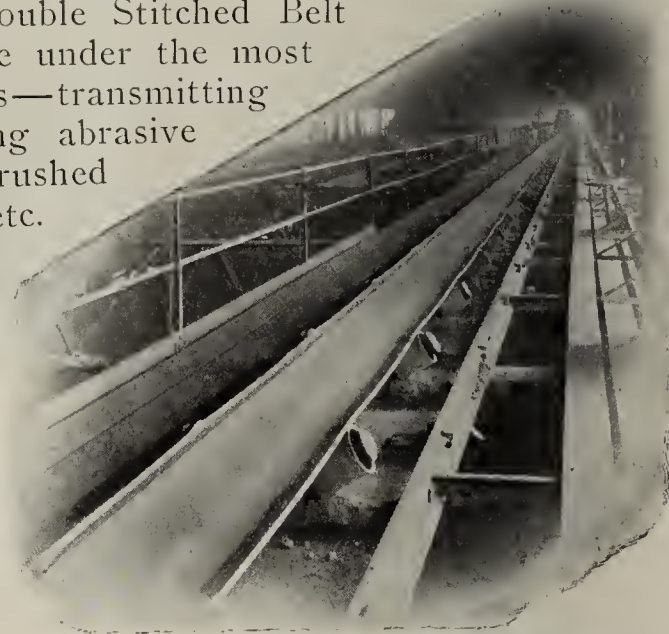
In mines and mills the world over you will find Black Giant Double Stitched Belt giving record service under the most severe conditions—transmitting power and conveying abrasive materials such as crushed stone, sand, gravel, etc.

Two cement companies alone bought during 1917 over Fifty Thousand Dollars' worth of Black Giant Double Stitched Belt.

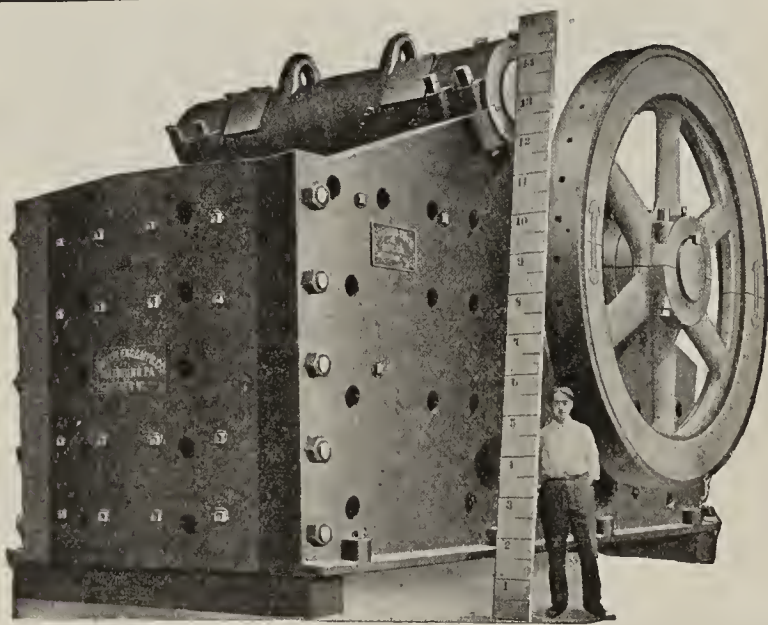
We would like an opportunity to demonstrate in your mill that this belt—because of its special construction and the compound with which it is treated—will give you better service.

McILROY BELTING & HOSE CO.

Hammond, Indiana



Black Giant Runs True and Even—No Spillage.



Traylor 60"x86" All Steel Jaw Crusher

TRAYLOR JAW CRUSHERS

Are Built in All Sizes from 7"x10" to 66"x86"

The 66"x86" is the largest crusher built.

All Traylor Jaw Crushers have cast steel water cooled pitmans.

Extra size pitman and swing jaw shafts of finest hammered steel.

Chrome steel toggle seats.

Manganese steel or chilled iron jaw plates.

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TRAYLOR BUILT MACHINERY

A CRUSHER FOR EVERY PURPOSE

We Make

In addition to JAW CRUSHERS illustrated

The Traylor Gyratory Crusher

The last word in Gyratorys.

The Traylor Crushing Rolls

They eliminate the personal equation in automatically preventing tire corrugations.

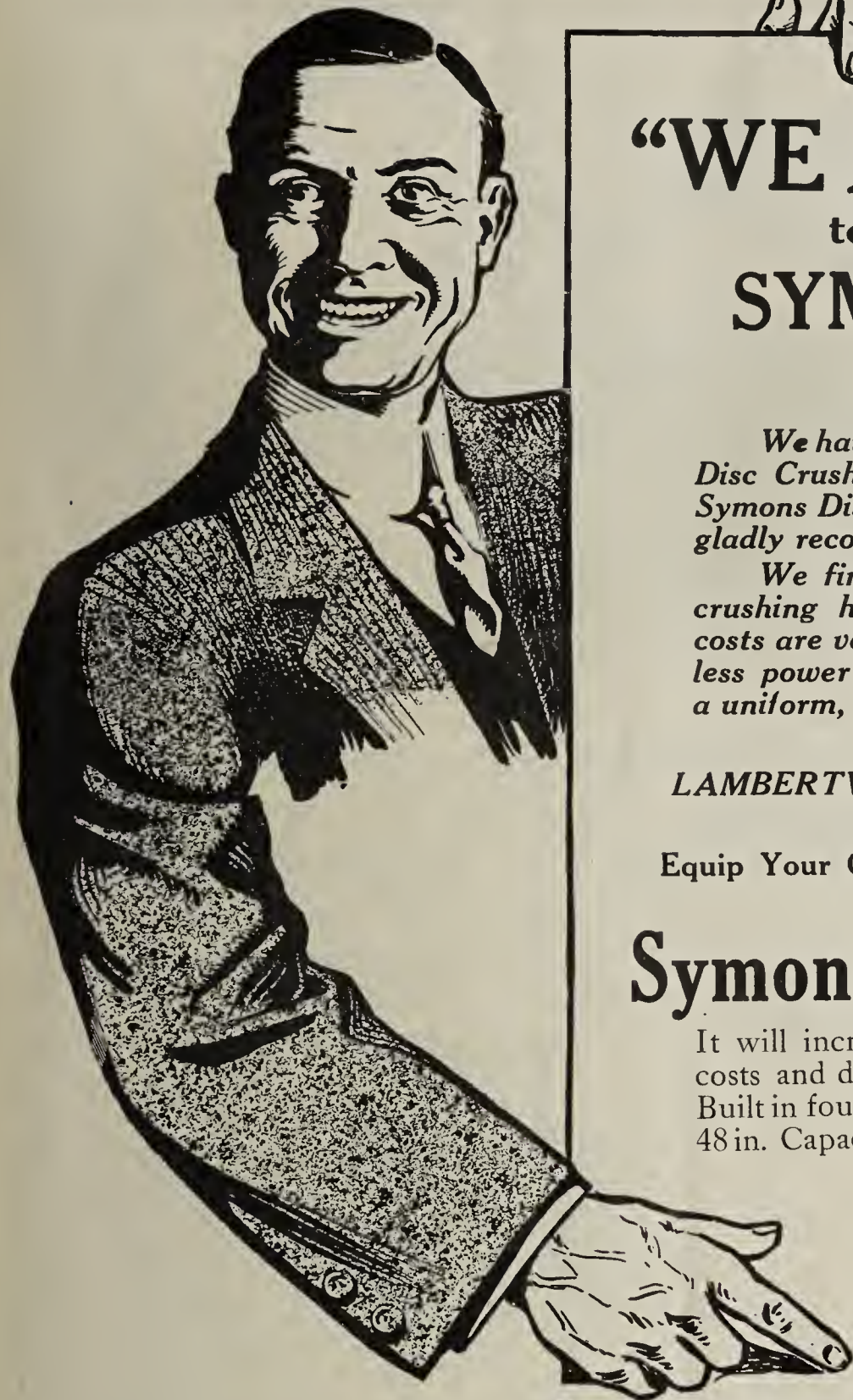
The Traylor Tube Mills

Long or short for wet or dry grinding. Have water cooled bearings of extra size. Positive automatic feed that assures maximum tonnage for minimum horse power.

The Traylor Ball Tube Mill

For reducing lumps to fines in one step.

"THE ULTIMATE CRUSHING EQUIPMENT"



"WE ARE GLAD"
to recommend
SYMONS DISC
Crushers

We have been using a 48-inch Symons Disc Crusher for 8 years and a 36-inch Symons Disc Crusher for 3 years and we gladly recommend them.

We find them very satisfactory for crushing hard trap rock. Our repair costs are very low and they require much less power than Gyratories they, deliver a uniform, clean product.

Signed

LAMBERTVILLE STONE QUARRY CO.
Philadelphia, Pa.

Equip Your Gravel and Crushed Stone Plant
with a

Symons Disc Crusher

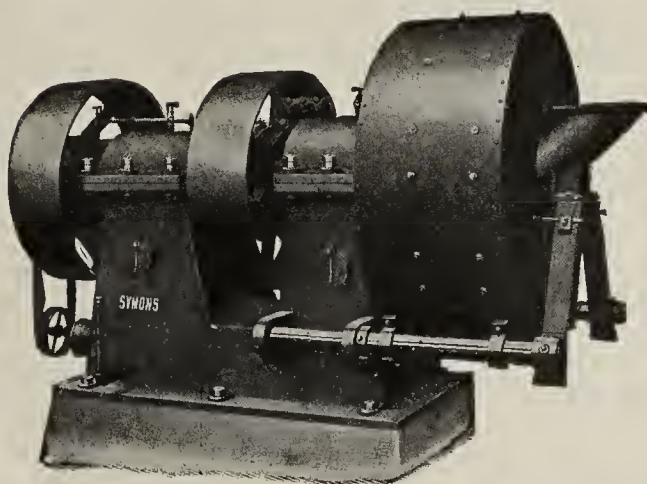
It will increase your output, lower your costs and deliver a more uniform material. Built in four sizes: 18 in., 24 in., 36 in., and 48 in. Capacities from 5 to 120 tons per hour.

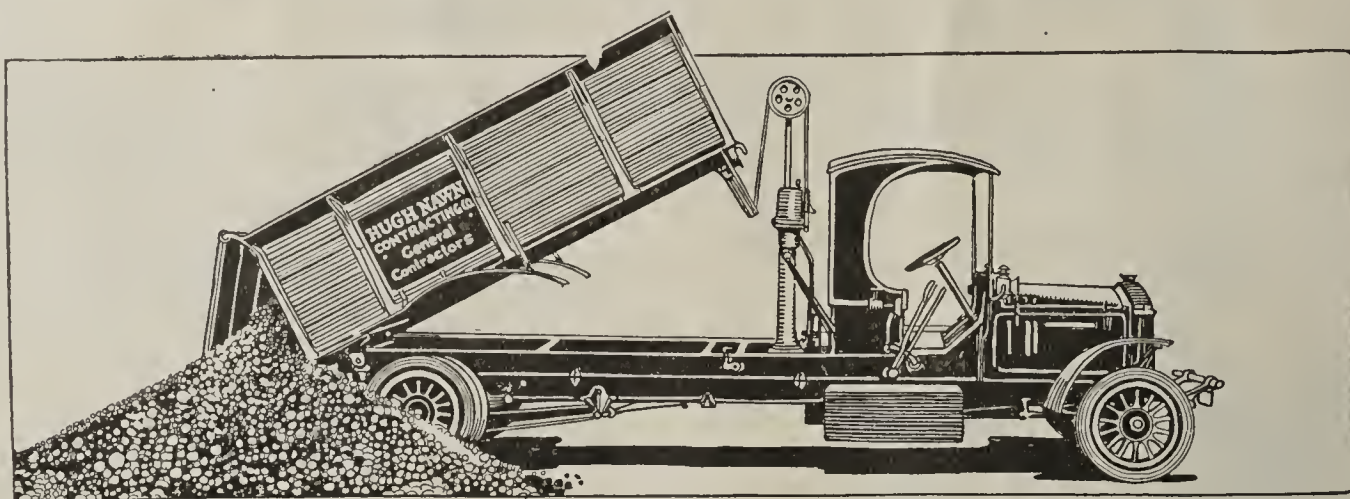
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Hugh Nawn compares year's operating costs for two well-known makes of Motor Trucks

Hugh Nawn, the Boston contractor, long ago realized that motor trucks are the most efficient and economical hauling units for large operations. The only question in his mind was which is the best truck.

His choice finally narrowed down to two well-known makes, one the Pierce-Arrow, the other a competitive truck of high reputation. For one year these trucks were kept on similar jobs, both operating under the same accurate system of cost accounting. Neither truck was spared, and the severity of service in rush work is shown by the high tire cost for both trucks. As a result of the comparative showing tabulated below, Mr. Nawn is satisfied that the Pierce-Arrow is the best truck made for contracting business.

COMPETITIVE TRUCK'S RECORD

Miles Run	13,095
Tonnage hauled	10,768
Gallons of gasoline consumed	4,521
Pints of oil consumed	1,176
Repairs to motor	\$740.37
Labor repair cost	249.25
Tire cost	888.79
Year's operating cost excluding insurance, depreciation etc.	3,520.27
Average operating cost per day including overhead	19.80

PIERCE-ARROW TRUCK'S RECORD

15,517 Miles Run	
11,013 Tonnage hauled	
4,389 Gallons gasoline consumed	
385 Pints of oil consumed	
\$136.16 Repairs to motor	
152.91 Labor repair cost	
841.78 Tire cost	
Year's operating cost excluding insurance, depreciation etc.	2,768.96
Average operating cost per day including overhead	16.78

A number of other interesting installations are shown in our booklet, "What Pierce-Arrow Motor Trucks Are Doing In The Contracting Business." We shall be glad to send you a copy.

THE PIERCE-ARROW MOTOR CAR CO., BUFFALO, N. Y.

PIERCE-ARROW

Motor Trucks

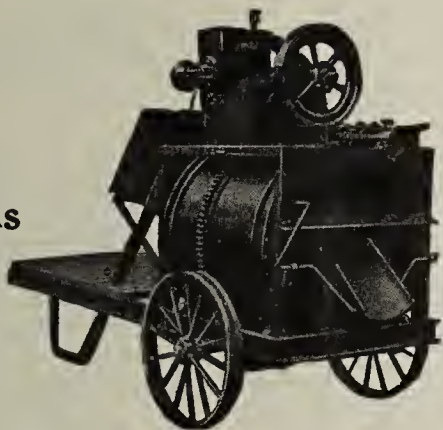
FOR MOST EFFICIENT FINE GRINDING CONCAVEX



ALLIS-CHALMERS

Milwaukee, Wis. U.S.A.

Deliver
Wet Mix
Direct
Into Forms



ARCHERS DO MORE

Archer Mixers do more for the contractor than any other mixer can. They do it because they are years ahead in design and construction. Just two of the many exclusive features that enable them to cut labor costs are:—

END DISCHARGE—Mixer can be backed up to the work and so discharge wet mix direct into forms. Saves three wheelers.

PORTABILITY—Two wheeled truck, so perfectly balanced that one or two men can move the entire mixer anywhere on the job.

ARCHER MIXERS are made in one model only: two sizes, one bag and half bag. Write for prices and terms of our "show me" offer.

ARCHER IRON WORKS
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Our Wish for You

That each month of this New Year would unroll for you as perfectly and as flawlessly as a roll of Hettrick Belting.

This wish we know is a worthy one—for we hope for you the best luck in the world. If your luck, your fortune, is as good as we wish it, then it is comparable to a roll of Hettrick belts; for it is full—plumb full—of satisfactory service.

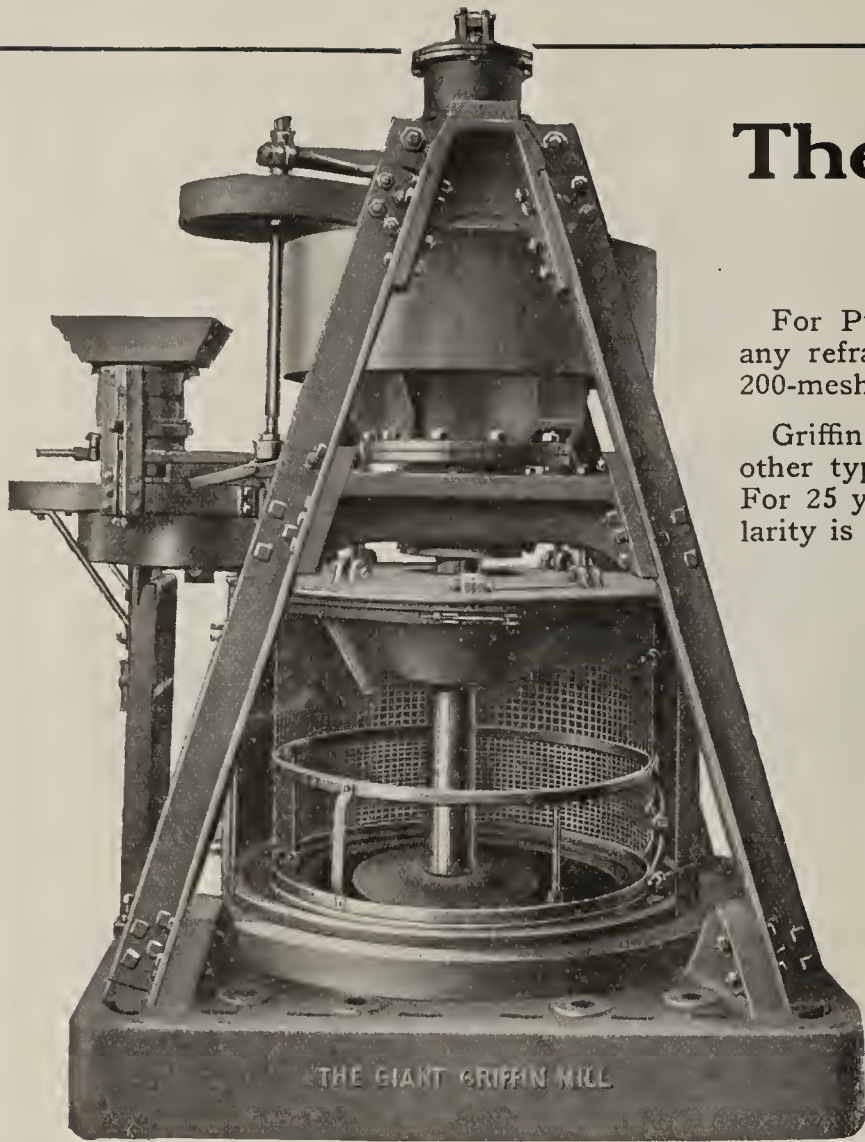
May our wish come true.

Sincerely,

The Hettrick Mfg. Co.
Toledo, Ohio



HETTRICK CANVAS BELTING
BEATS THEM ALL



The Improved Giant Griffin Mill

For Pulverizing Coal-Cement Clinker, Raw Material or any refractory material where a fineness of 83% through a 200-mesh screen is required.

Griffin Mills are used by Cement Plants more than any other type of pulverizer. Now in operation in 45 plants. For 25 years they have led the procession and their popularity is increasing.

Recent improvements have reduced their former low H. P. and Maintenance Cost to the Minimum. Why not investigate this new Griffin Mill?

Recommended for Agricultural Limestone Producers as well as Cement Producers.

GRINDS ANY DRIED REFRACTORY MATERIAL.

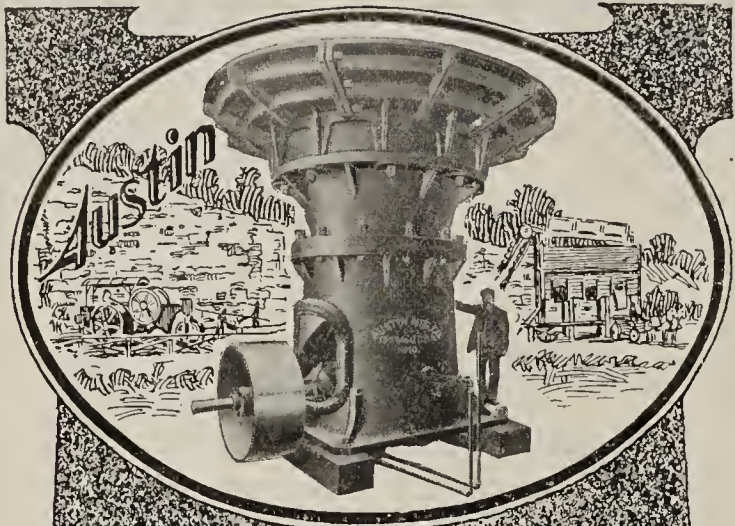
Our Engineers Are at Your Disposal.

Bradley Pulverizer Co.

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AUSTIN ROCK CRUSHERS ARE PROFIT PRODUCERS

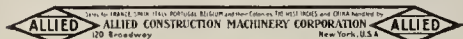
There is a constantly increasing demand for rock products. It will continue after the war, when building of all kinds—everywhere—will be conducted on an unparalleled scale.

Austin Crusher-equipped quarry operators are prepared to get their share of this business. Austins deliver large outputs at minimum cost.

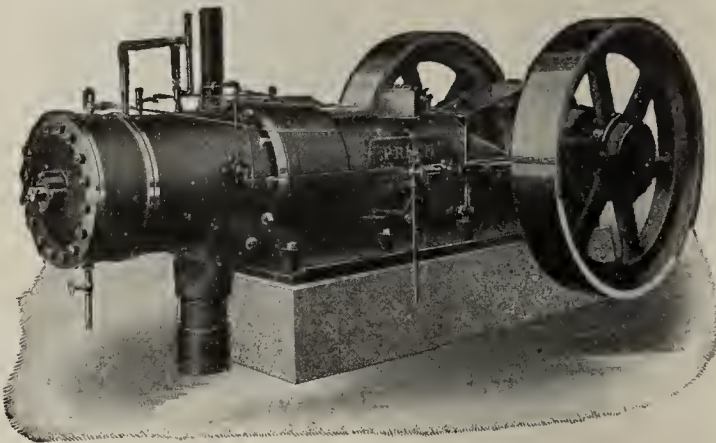
Made in 8 sizes—50 to 5,000 tons per day—Stationary and Portable types.

Write for information on Austin rock-crushing and road-building equipment.

AUSTIN MANUFACTURING CO.
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Looks like
Operates as smoothly as
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As dependable as

} **A Steam Engine**

But burns crude oil or any of its cheaper by-products thereby greatly reducing your power costs, no matter what kind of prime mover you are now using.

A size and type for every need illustrated in our catalog. Visit our big modern plant.

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MARION, O.

Cement and Engineering News

Vol. 31

Chicago, January, 1919

No. 1

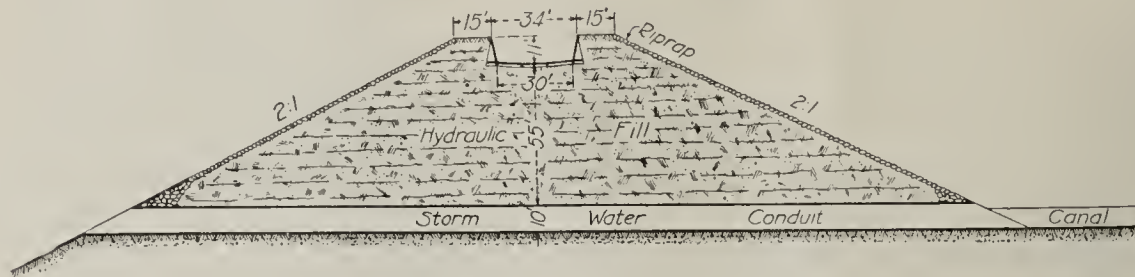


A Concrete Irrigation Flume on Earth Embankment, Furlock Irrigation District, California (See Following Page).

A Concrete Irrigation Flume on Earth Embankment

In many of the earlier irrigation developments throughout the West, timber has been extensively used in the construction of flumes and trestles to carry the principal canals across ravines. The use of timber in these projects was no doubt governed by the limitation of low first cost and a desire to obtain simple and rapid construction. From the standpoint of economy, however, it has not proved a success in these works,

As the height of the embankment increased it became necessary to abandon the first borrow pit and convey material from a greater distance, and sluicing was therefore begun at the second pit, more than 1,000 feet from the fill. Owing to the presence of an intervening ledge of soft sandstone it became necessary to lead the distributing flume through a tunnel 90 feet in length. From the borrow pit to the tunnel 22 inches



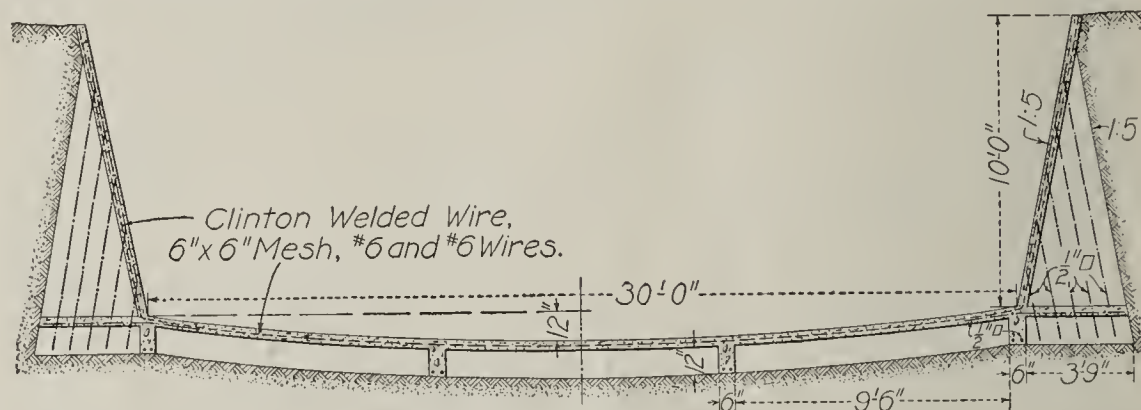
Cross Section of Embankment.

as shown by the fact that many of these structures have had a life of only about ten years. It has, therefore, become necessary to rebuild many of these timber trestles and flumes with more substantial and lasting materials, in order to eliminate the constant and ever-increasing expense of repair and reconstruction.

In undertaking recent extensions and developments of the Turlock Irrigation District in Stanislaus and Merced Counties, California, it was deemed economical to replace trestles carrying flumes of the main canal with earth embankments wherever practicable, and use, on these embankments, channels lined with concrete in place of the timber flumes as previously

light steel pipe was used instead of a flume, as it could be moved more readily.

Water for sluicing was led through the main canal to a sump over which two high-duty Lea pumps were located. The sump was 100 feet below the monitor, which was connected by a 6-inch steel pipe to one of the pumps. The suction pipe tapered from 24 to 14 inches and was primed by an air pump operated by a 1½ horsepower motor. A second turbine pump, operated by a 100 horsepower motor, discharged into a 10-inch steel pipe which delivered additional water directly in the borrow pit. The monitor nozzle was 1½ inches in diameter and the normal pressure produced



Cross Section of Flume.

used. This work was begun with the construction of an earth embankment to replace the timber trestle carrying the main flume across Delaney Gulch, at a point 30 miles east of Turlock and 2 miles southwest of the town of La Grange.

At this crossing the grade of the flume was such as to require a fill having a maximum height of 76 feet.

With a top width of 64 feet and side slopes of two to one, this fill, which was made by sluicing, required the deposition of more than 200,000 cubic yards of filling material. For the lower portion of the embankment suitable material was obtained from a borrow pit located about 600 feet from the toe of the embankment. It consisted of a mixture of 20 per cent gravel and 80 per cent clay, which was first loosened with black powder and then sluiced with a Joshua Hendy monitor to the distributing flume. The dimensions of the distributing flume were 10x16 inches, and the average ratio of silt to the water used in carrying it was 3 to 10 parts by volume, although this ration was subject to considerable variation owing to the carrying proportions of gravel in the aggregate.

by the single turbine was 150 pounds per square inch. When greater pressure was necessary in order to disintegrate the material, connection was made with the 6-inch turbine, the two operating together in such a way as to furnish a pressure of 225 pounds at the monitor. Power was obtained from the 30,000-volt transmission line of the Yosemite Power Company and transformed to 440 volts at the pumps.

Eight discharges, four on each side of the main distributing flume, delivered upon the embankment. Waste water was carried off through a vertical outlet 2 feet square connected to the main concrete culvert extending through the fill. Sheerboards 12 inches wide by 8 feet long were used for distributing the sluiced material.

The permanent flume, which is 30 feet wide at the bottom and 34 feet wide at the top, is built on the crest of the embankment and consists of an open channel 11 feet deep lined with reinforced concrete. The concrete lining for the bottom of the flume consists of a 4-inch slab of concrete surmounting longitudinal and transverse ribs of concrete 6 inches wide and 12 inches deep.

Editorial

Reconstruction Policies

The first duty in the whole situation is the maintenance of an unwavering confidence and to promptly apply the brakes at the first tendency to listen to the whisperings of fear and foreboding.

The next duty is to look for an underlying policy, and that policy ought to follow very closely the basis of our Liberty Bond loans—continued saving so as to make possible an up-keep of expenditures. It takes money to finance activity, and without activity labor will not find employment, so that the limiting factor in the whole program is that of finance.

The new saving must not, however, be a process of threadbare denial, but by the substantial method of earnings and accumulation. Real saving is the establishment of a margin of surplus between the cost of living, personally, and the income from labor, or the cost of production, industrially, and the sales value of commodities.

Industrially, we must work out every angle of economy in finance, production, subsistence and transportation, and millions properly invested in these directions will increase our final margin of surplus. To continue to save, and to continue expenditures for purposes of economic strength, and to always have supreme confidence in results, is the definition both of the problem and its solution.

It is not wise to look chiefly to foreign trade in the hope that it will be the one great remedy. It takes money to buy goods. To sell to a depleted Europe we must extend liberal credit, and to do that we must insure, by wise economy, the protection of ample reserves at home.

For the immediate future, it is very apparent that the product of our farms, food, clothing, leather, etc., will be in great demand. American farmers should continue to prosper, and we have always prospered as they did. Eventually, however, we must recognize that self-determination, politically, will be followed by every attempt to be self-sustaining, economically, and the consequent limitation of imports.

Whether in foreign trade or at home, the new need is one of quality production on an economical basis. Only in this way can we stimulate both our domestic consumption, fortify our foreign trade, and keep our industries busy and labor employed. The problem comes to our very doors, and has an individual interest and responsibility for banker, employer and employee alike.

The problem of reconstruction is lost in our opportunities for continued development.

Our railroads need extensive additions in facilities and equipment. The Mississippi Valley and its most fertile of soils lies undeveloped; the river with but a trace of terminals or equipment, the alluvial lands chiefly unreclaimed. Our public utilities, especially street car lines, are, many of them, in lamentable condition. Central power stations need additional units all over the country. Motor trucks, automobiles and highways are required for the service of the millions.

Thousands of farms are in need of buildings, equipment and greater home comforts.

New construction, long delayed, will be influenced by the modern trend of durability, sanitation and taste.

The right way and not the expedient way is the new order of things.

Community organizations and municipalities face unusual problems and opportunities. Housing, food and related conditions must be worked out on the most efficient basis. Such results will develop the highest type of industry, a better average wage scale, and increase the net worth in the community.

And industry should be given every freedom. Industrial combinations that will reduce overhead costs, systematize production and effect other economies should be encouraged, even if necessary to change any restrictive legislation.

Individual enterprise has developed our industries in the past. The only danger in the situation today is the discouragement of initiative and development by ill-conceived legislation and over-regulation.

Good faith, confidence, honor and freedom is the basis on which America does business.

Highway Congress Meeting

The first Highway Congress in the history of American road building opened in Chicago on December 9, 10 and 11th under the auspices of the American Association of State Highway Officials and the Highway Industries Association. Practically every state in the Union was represented.

Lt.-Col. Wm. D. Uhler, President of the American Association of State Highway Officials, opened the Congress. An address of welcome was delivered by Governor Frank O. Lowden. Responses were made by Edwin S. Duffey, of New York, for the Association of State Highway Officials, and S. M. Williams, of Ohio, as President of the Highway Industries Association. In his response Mr. Williams said:

"When one of our leading publications recently stated that the Highway Industries can well afford to entirely ignore any thought that in working for good roads they are working in their own interests, but that they are working for the interest of the nation, and every mile of good roads built adds to the sum of human happiness and to the nation's ability to utilize its resources for the production of foodstuffs and for increasing its manufacturing facilities, they expressed the same thought and purpose which caused the highway industries of the United States to come together in the organization of the Highway Industries Association about one year ago.

"The Highway Industries of the United States, representing invested capital of more than two billions dollars and more than one million wage earners, sincerely and honestly believed it was their patriotic duty, rather than a selfish privilege, to urge that 'Highways must be aggressively advocated as essential to the nation's life.' This duty was magnified by the recent statement from Herbert C. Hoover, Federal Food Commissioner, that 50 per cent of the perishables produced in America are wasted largely through ineffective means of getting them to market. He also predicted that the food shortage would become more serious in the United States after the war than during the war and therefore urged the importance of increased efficiency in highway transportation.

"We are all here believing that we have reached a

point in the life of our country when it is the duty of all to call a halt in the neglect of our highways, and to urge upon those in authority a realization of the penalty that we as a country are paying for our neglect. Governor Lowden, we appreciate your welcome to the State of Illinois and City of Chicago, and we sincerely congratulate you and the people of your State upon their splendid start towards better roads in Illinois by their recent approval of the \$60,000,000 bond issue."

Our Readjustment Problems

The most important of the immediate problems before the United States are of an industrial and financial nature, for we are facing the possibilities of financial unrest and industrial chaos. But prompt and proper governmental action can prevent both these possibilities materializing into realities. Shortage of labor has been a chronic condition in this country, because of our vast resources which have scarcely begun to be developed. Consequently, I do not view with alarm the task of reabsorbing our 3,000,000 soldiers into industrial life, provided we take adequate precautions to avoid a too rapid and carelessly thought-out demobilization.

The solution seems to me to lie in releasing first the men most needed from an economic standpoint in our industries, followed by the gradual discharge from the army of the remaining forces which are not required for European police duty and home defense, and coupled with the launching of public projects by National, State and Municipal Governments. We have empires in our waste places awaiting reclamation; there are deserts to irrigate, swamps to drain, rivers to harness for hydro-electric power, highways to build, railroads to extend.

There are huge private construction enterprises also awaiting an opportunity to get under way. It has been estimated that at least \$500,000,000 worth of such undertakings can be started at once. Experts have declared that fully five years and as many billions of dollars will be needed to catch up with our general building requirements. In brief, there is more work to be done in this country than we shall have labor to accomplish, if we take full advantage of our unequalled opportunities.

Some of England's Plans for Demobilization

England has supplied us with many guide-posts in the war and she may furnish us with others in the transition period. It is worthy of note that elaborate plans have been made by the British Government to provide employment for each soldier leaving its service. The British machinery of war is being converted into the machinery of peace as expeditiously as possible, so that there will be no period of industrial depression and distress due to the idleness of workers.

Money grants to civilians and former soldiers who are unemployed, owing to peace, are to be provided. There will be extra allowances for dependents. These grants will run for thirteen weeks for civilians and twenty-six weeks for discharged soldiers.

Men employed in "pivotal industries" and mines will be the first to be discharged from the army, and workers in other trades will be released according to national needs. Married men will receive preference. For a year after the war, permanent appointments to the civil service will be reserved to officers and soldiers.

Plans are being worked out to give soldiers special facilities to obtain land. Men from the Dominions employed at war work in England will be quickly released. The Ministry of Munitions will be supplanted

by the Ministry of Supply, which will dispose of war stores. Production of materials needed in the building trades will be expedited. Iron and steel will be released from control at once, and other metals will be placed on the pre-war basis in six months.

There has been no general discharge of British munition workers as yet. The scale of war wages in England in all trades continues high, because of the high prices of the necessities of life.

Wages and Prices

Perhaps the most mooted question before us today is that regarding the continuation or decline of existing prices and wages. Opinions on this subject vary greatly. But one thing appears to be certain, namely, that the problem is fraught with unpleasant possibilities. An indication of such possibilities cropped out only a few days ago, when a prominent representative of employing corporations in manufacturing industries declared that the eight-hour day would have to be abolished and that wages must recede from their present level; to which the leader of a great labor organization replied with this note of warning:

"Our movement is not to destroy but to construct, and all may just as well understand now as at any other time that the advantages which the workers of America and the allied countries have gained and which we hope to extend even to the peoples of the conquered countries are not going to be taken away from us, and we will resist the attempt to the uttermost."

It would appear, however, that in this sharp exchange of ideas both the representative of employers and the spokesman of employees did not consider the most potent and really determining factor in the situation, namely, the basic law of supply and demand. The War Industries Board struck the true keynote in explaining a few days ago that it had abandoned the schedule under which grades and prices of shoes were classified from \$3 a pair up to \$12, because "increased production and competition are counted upon to regulate price levels."

There can be no arbitrary reduction of wages to the pre-war basis. Were such folly attempted employers would suffer as much as employees, and capital as much as labor. That there will be a gradual readjustment is inevitable, but we should remember that for every loss there is some compensation. If wages are gradually lowered there will also be an accompanying reduction of prices; consequently, labor will lose none of the just advantages gained during the war, and of which no far-seeing employer would desire to deprive labor. But labor must accept its readjustment of dollar value like the rest of us.

Let us hope that America will be so busy from now on that peace production will be great enough to maintain wages at a high level. And let us hope also that employers and wage-earners will carry into the transition period and into the future for all time the realization, awakened by patriotism during the war, of their joint responsibility, and that they will perceive the wisdom and the blessings of industrial peace. The spectacle afforded by Russia today ought to be a lesson of what any other course may develop.

Concrete Dwellings

The Pennsylvania Cement Co., Bath, Pa., is building a number of all-concrete dwellings for its employees. The structures are double residences, with all modern improvements and finished in cypress wood, and are located in Penn Street.

Recent Developments in Fine Grinding

By R. C. Newhouse

About ten years ago users of pulverizing machinery became interested in several high-speed grinders which were claimed more efficient as finishers than Flint pebble tube mills then in very general and satisfactory use for that purpose. While it is generally admitted that Flint pebble tube mills as then built are superior, as fine grinders, to any high speed machines then and now obtainable, the small, wear-resisting metallic grinding medium "Ball-Pebs" since introduced has so greatly increased its efficiency that it stands today without a rival as a fine grinder for cement and other abrasive substances.

To obtain in full measure the advantage of this great improvement required carrying the grinding charge as heretofore, at about the center of the mill. This increased the weight of charge $2\frac{1}{2}$ times. Allis-Chalmers engineers, quick to recognize the importance of this great improvement, were the first to develop and manufacture the "BALL-PEB MILL" with parts adequately designed to take full advantage of this great step in advance in grinding practice. This still left the problem of adapting existing mills to the use of Ball-Pebs.

(a) Many operators simply substituted for the flint pebbles an amount of Ball-Pebs which would not overstrain the mill or its driving connections. In time, as a further improvement, ribbed liners were substituted for silex or smooth iron liners previously in use with flint pebbles. This method, though not obtaining maximum results, gives better efficiency than flint pebbles.

(b) In some cases mills were reconstructed to carry the heavier loads. While this is satisfactory in operation, the first cost is necessarily high.

(c) Another alternative is to reduce the inside diameter of mill to such size that when charged to the center the mill and its driving connection are not overstrained. The principal objection to this method is the recognized lesser efficiency of smaller diameter mills.

(d) Another alternative is the use of division heads to blank the center of mill and carry the Ball-Pebs to near the center in two ends. This method also gives satisfactory results, but necessarily introduces additional wear on the two division heads.

Until recently small spheres, cylinders, nut and boiler punchings have been the most common forms of metallic grinding bodies. Efforts have been made to improve upon these by studying and experimenting with special shapes.

Laboratory experiments showed that boiler punchings of much greater diameter than thickness ground more efficiently than spheres or ordinary cylinders from feed 75 per cent through 200 mesh to discharge 80 per cent through 200 mesh; but, for grinding from minus 20 or minus 30 mesh, spheres, because of their greater weight, rolling and pounding action, were more efficient than cylinders or boiler punchings which have principally a sliding action. The first experiment showed the necessity of area of contact and the latter that for customary grinding, rolling and pounding is necessary to reduce the larger particles.

An entirely new article, the CONCAVEX, resulted from the effort to combine in one body these two very essential features. As its name implies, it has both concave and convex surfaces, the preferred shape of manufacture being a sphere with two sides cupped, forming concave surfaces with radius about the same as the sphere.

CONCAVEX are made in various diameters, size of feed and desired fineness of product determining the diameter to be used. In cement mill practice the $1\frac{1}{4}$ -inch concavex are the best substitute for the $\frac{7}{8}$ -inch ball-pebs. The very large contact area, due to their shape, gives them great efficiency. Their peculiar shape tends to eliminate shrinkage strains, thus permitting the use of much harder mixture without sacrificing strength.

Of greatest importance to users of flint pebble tube mills, is that with CONCAVEX the expensive reconstruction necessary to use metallic grinding bodies efficiently in such mills is eliminated. On account of their interlocking shape their angle of repose is greater; consequently, a low charge is carried higher in the mill, and therefore attains the rolling action found in mills charged to the center line, and without over-stretching the mill or its driving connections,—thus offering a means heretofore unavailable to convert such mills to efficient grinders at reasonable first cost.

Concrete Ship a Success

The first concrete ship ever built has just been examined by experts and pronounced a success, though minor faults in construction, which can easily be avoided, have been detected. If a pun may be pardoned, the faith placed in the Faith by her builders has been justified. Launched last spring the Faith has voyaged back and forth between San Francisco and other ports many times, having a mileage of 11,000 miles to her credit. She has ridden through storms without damage, maintaining such an even keel that plates and glasses on her tables were not shaken off, though there is not a single protective plate rail on the vessel. The only evidences of her trips were faint hairlines, which were said to be due to shrinkage rather than to her yielding to any strain put upon her. The examination of the Faith was made by officials of the United States Shipping Board Emergency Fleet Corporation, officials of the company which built her, experts from the cement company which furnished the special grade of cement used in her construction and a number of naval architects and engineers. Nearly two hours were passed in going over the vessel, from the bottom of the hold—she arrived in ballast—to the topmost deck. In spite of strenuous weather the vessel did not leak. She did not require any more fuel than vessels of wood or steel, and in every way met the requirements of the service. From this we can conclude that the "stone" ship is here to stay unless the cost of building is against it. This cost is somewhat higher than for wood vessels, but the concrete ship, say experts, is as economical to operate as any other ship.

Highway Work

Mr. L. W. Page, Director of the Office of Public Roads, issued on November 25 to all State Highway Departments a letter urging the vigorous prosecution of all public improvement work and particularly road work; because of the effective means of insuring employment particularly to unskilled labor in the transition period from war to peace. Mr. Page mentions that during 1919 it is quite probable that more than 100 millions of dollars of State and Federal money will be available for road work and he offers the assistance of the Bureau of Public Roads to the States in dealing with the various problems which may arise.

Present Knowledge of the Setting Action of Cement and Plasters

In order to focus attention on the gaps existing in the present knowledge of setting action that occurs in cement and plasters an international discussion of the subject was held last winter by the Faraday Society of London. The discussions presented at the meeting are summarized in *Concrete* as follows:

The Setting Process, in Plasters and Cements.—Dr. C. H. Desch, University of Glasgow, opened the discussion with a paper on "The Mechanism of the Setting Process in Plaster and Cement."

The setting of plaster occurs in a manner which has been satisfactorily explained by Le Chatelier, through the formation of a supersaturated solution and crystallization of hydrated gypsum in spherulitic groups of needles. The same explanation may be applied to the setting of soluble salts, of magnesian and other similar cements, and of barium silicate. In regard to the more complex Portland cement class, two rival views have been maintained. On the one hand, Le Chatelier holds that the basic silicates and aluminates which constitute the cement form supersaturated solutions, and that the products of hydrolysis then crystallize in the same manner as plaster, while other investigators adopt the view of Michaelis, that the products are of a colloidal character, and that subsequent processes of crystallization play little, if any, part in contributing strength to the mass. The most recent investigations, those of the U. S. Bureau of Standards in Washington, confirm this explanation. When closely examined, it is seen that the difference between the rival hypotheses is partly verbal. It is admitted that the crystals which are formed when cement sets are exceedingly minute, even of ultramicroscopic dimensions, in which case the surface forces become comparable with those which determine the crystalline form. One may adopt the view of von Weimarn, that the passage from the crystalline to the colloidal state with diminishing size of particles is a continuous one. The size of the particles formed in the setting of cement is undoubtedly very small. The differences between the observations of different investigators may be attributed in part to experimental conditions, small quantities on a microscope slide yielding crystals more readily than a mass of cement gaged as in use.

Crystalloids Against Colloids in the Theory of Cements.—Professor Henry Le Chatelier, Paris, sent in a contribution to the discussion, entitled "Crystalloids Against Colloids in the Theory of Cements."

The author considers the theory which attributes the hardening of cements to certain colloidal properties of the material to be devoid of sense, for a colloid is taken to mean a body capable of hardening, and thus the theory is merely a definition. All very minute insoluble bodies give colloidal suspensions. The absorptive power of these bodies is only a particular case of much more general properties. Only insoluble bodies can preserve an extreme state of subdivisions, hence colloids never show any discernible crystalline form.

In plaster, crystals may not be visible, but that is only due to their extreme minuteness. When the humid hydrated plaster is left to itself, crystals become discernible in time. Similar considerations apply to the calcium aluminates. In the hardening of Portland cement calcium silicate is the essential element; by analogy with barium silicate, hydrated calcium silicate may be said to crystallize, but in minute crystals, initially of colloidal dimensions, but in course of time they grow. As the mechanical resistance does not diminish with time, the colloidal state has nothing to do with the hardening, the explanation of which is

the progressive crystallization of hydrated compounds of cement from a supersaturated solution, produced by the greater solubility of the anhydrous compounds. The crystals produced from such solutions are in the form of elongated needles, and the entanglement and close adhesion of these causes the solidity of the mass.

The Agglomeration of Granular Masses.—Professor F. G. Donnan, F. R. S., contributed a paper on "The Agglomeration of Granular Masses."

Attention is drawn to the four principal factors which tend to cause the caking, binding, or setting of granular materials, namely, the presence of unequally distributed stresses, of granules of unequal size, of unstable or metastable forms, and of sheared crystal faces. In all of these cases the material under one of the stated conditions is more soluble than the other forms; thus solids under stress are more soluble than when unstressed, smaller granules than large granules, metastable than stable crystalline forms, and the amorphous surface of a sheared crystal possesses higher solubility than the stable crystalline surfaces. Hence, if the two forms exist side by side in contact with a solvent, the material will be dissolved from the one form and reprecipitated on to the other form, and so bridges of reprecipitated material will be produced, which will cement the separate particles into a compact mass. The operation of molecular forces under these conditions is fairly well understood, but it is not sufficiently known or appreciated by many occupied with industrial problems.

The Constitution and Hydration of Portland Cement.—A. A. Klein, Worcester, Mass., sent a paper on "The Constitution and Hydration of Portland Cement."

A short historical sketch of research along the lines of Portland cement from the time of Vicat to the present is given. Three theories have been brought forward as to the constitution of cement: (1) That entailing solid solutions, (2) that of a lime-silica-alumina compound, (3) the presence of separate silicates and aluminates differing in hydraulic properties. Of these the third one is undoubtedly correct, and the essential compounds of cement are tricalcium silicate ($3\text{CaO} \cdot \text{SiO}_2$), tricalcium aluminate ($3\text{CaO} \cdot \text{Al}_2\text{O}_3$), and the beta modification of calcium orthosilicate ($2\text{CaO} \cdot \text{SiO}_2$).

The presence of free lime denotes under-burning, while the compound $5\text{CaO} \cdot 3\text{Al}_2\text{O}_3$ may be present as a result of under-burning or of a raw material mixture low in lime and high in alumina. Magnesia in small amounts replaces lime in the silicates and aluminates, and iron occurs coloring the dicalcium silicate, as well as in a deeply colored isotropic flux material. The chemical changes involved in the burning of the clinker are discussed, as are the temperatures of formation of the various essential constituents. A summary is also given of work done on the hydration of these constituents under varying conditions, with a special reference to the new compounds formed and the speed of reaction with water. The hydration of cement itself is then considered from the time of mixing until after 28 days, and the conclusions are drawn as to the constitution of a cement with a view to obtaining the best setting cement from a standpoint of expansion, porosity and disintegration through external agencies.

The Setting and Hardening of Portland Cement.—A paper by G. A. Rankin, of the Geophysical Laboratory, Washington, entitled "The Setting and Hardening of Portland Cement," was read by Dr. C. H. Desch.

The paper records an experimental study of the

hydration of the separate constituents of Portland cement clinker, namely, the minor constituents, lime and $5\text{CaO} \cdot 3\text{Al}_2\text{O}_3$, and the major constituents, tricalcic aluminate, dicalcic silicate, and tricalcic silicate. From this study it is seen that the initial set in Portland cement is probably due to the hydration of tricalcic aluminate; that the hardness and cohesive strength at first are due to the cementing action of the amorphous material produced by the aluminate and of tricalcic silicate; and that the gradual increase in strength is due to further hydration of these two compounds, together with the hydration of dicalcic silicate.

The value of Portland cement depends upon the fact that when finely powdered and mixed with water an amorphous gelatinous-like material is formed on the individual grains, cementing them together. This amorphous material results from the major constituents, tricalcic silicate, dicalcic silicate and tricalcic aluminate. Of these constituents, the compound tricalcic silicate, which makes up about 30 per cent to 35 per cent of an average normal Portland cement, is the one which hardens and develops the greatest strength within a reasonable time. This is due to the gelatinous hydrated silica which is readily released when this compound, in a finely powdered state, is mixed with water. The essential process for the manufacture of Portland cement is the formation of this compound. Unfortunately, the increase of the percentage of the tricalcic silicate does not appear economically possible at present. A more feasible plan of attack for improving cements would appear to be to release hydrous silica from some compound such as dicalcic silicate, which contains a higher percentage of silica than tricalcic silicate, by the dissolving action of some suitable electrolyte. Investigation along these lines may result in the discovery of a cement which will enable us to prepare a concrete closely approaching the ideal; grains of sand cemented together with hydrous silicate—the toughest of sandstones.

The Colloidal Theory of Setting.—John Rhodin pointed out the similarity between the setting of cement and the behavior of zeolites towards water. These minerals lose water by careful heating and becoming non-transparent, but the original transparent crystals are reformed by simple immersion in water. The author had produced zeolitelike compounds by interaction between feldspar, salt and lime at 900°C . and subsequent washing out of the soluble salts. These compounds, when heated with more lime, gave white cements, the setting of which could be watched under the microscope, when the formation of interlocked translucent crystals could be easily seen. He also pointed out curious cases of rapid decay of cements.

Ancient and Modern Mortar.—W. J. Dibdin read a paper on "Ancient and Modern Mortar," of much historical interest.

The comparison between ancient and modern mortars presents many points of interest, particularly in regard to the quantity of lime, the character of the aggregate, and the presence of clay. The strength of certain old mortars has been quoted as if the art has been lost, but properly compounded modern mortars frequently possess strength equal to the best old samples.

An important point is that relating to the quantity of lime used. In some instances, the volume of lime is measured as dry unslaked lime as received from the kiln. In others, the lime has been first "dry-slaked" and the required quantity taken from the powdery mass, which has a volume per unit of weight of unslaked lime greater than that originally. In some cases the

slaked lime is first made into a "putty," kept for a time, and then measured in that condition. All statements of proportions of lime to aggregate are generally given in terms of volume unslaked lime.

The analysis of a series of ancient mortars showed that the volume of aggregate to 1 volume of unslaked lime varied from 0.4 to 3.7, but the average of these was about 1, as compared with the modern practice of 3. The best results of a large number of mortars prepared for experimental purposes showed, out of 15 samples, that 11 contained 2.0 to 2.5 of aggregate to 1 of lime. The ancient mortars therefore contained more lime than is considered permissible in modern practice.

Modern specifications of the aggregate to be used for the mortar generally state that this is to be "clean, washed sand, etc." The results of the analyses of ancient mortars of the 12th and 13th centuries, and that of the London Wall, showed that the proportion of aggregate was not only less, but its character was largely that of gravelly sand with clean ferruginous clay.

In the samples of mortar from Allington Castle, early 13th century, the relative proportions of lime to sand, etc., were 1 to 1.7, 1 to 1.1 and 1.9. The percentage of clean ferruginous clay was respectively 8.6 per cent, 3.66 per cent and 4.0 per cent on the sand, which was fairly coarse.

Samples of Roman mortar contained clean lime and broken brick only; while another from Threlfall Castle, near Hythe, contained clean flint and pebbles for the aggregate.

As showing the character of some of the mortar used after the Fire of London, a sample from Painters' Hall, built by Sir Christopher Wren, contained lumps of lime, some soft and some hard, the "sand and grit" consisting of broken red brick and organic debris, evidently old rubbish from the ruins of the Fire.

The results of special experiments show distinctly the reason of the advantage gained by the early builders in fixing their ratio at about 1 to 2 and the use of a coarser aggregate. The modern rush after economy, by reducing the quantity of lime, is very largely responsible for the falling off in quality.

The use of clay is disadvantageous with white chalk lime and greystone lime, but with blue lias lime a marked improvement is sometimes obtained.

An essential factor in regard to the strength of mortar is that relating to the voids between the particles. A mortar made with a sand having 40 per cent of voids had a crushing strength of only 70 lb. per cu. in., while with a sand having only 23 per cent of voids the crushing strength was 154 lb.

The suggestion that soluble silicates are formed in the course of time is not borne out in the author's experience. The examination of numerous samples of ancient mortar revealed the presence of no more soluble silica than is normally found in ordinary fresh-made mortar. Certain cases are met with in which the soluble silica is much higher, but in such instances the character of the mortar leads to the conclusion that trass or pozzuolan, etc., had been employed.

The setting of mortar was ascribed by Graham to the fact that "on drying the mortar binds the stones between which it is interposed, and its own particles cohere so as to form a hard mass solely by the attraction of aggregation, for no chemical combination takes place between the lime and the sand, and the stones are simply united as two pieces of wood are by glue." "From the minute division of the silica and alumina in hydraulic mortar, their combination with lime is more likely to occur than in ordinary mortar. Still, the fixing of the hydraulic mortar seems to be chiefly due

to the fixation of the water and formation of a solid hydrate like gypsum." This view entirely agrees with the author's experiments.

Effect of the Addition of Slag on the Setting of Cement.—A paper by E. Deny, I. A. M., Ghent, and E. H. Lewis, M. A., Wishaw, on "The Effect of the Addition of Suitable Slag on the Setting Properties of Portland Cement," was read by Mr. Lewis.

The authors were not able to communicate results of laboratory research into the setting of Portland cement, and gave only certain results which had been obtained by them in the manufacture on an industrial scale of the class of cement which in German would be called "Eisen" Portland. These, as far as they go, confirm the results given by Dr. Passow.

The cement made from blast furnace slag is, of course, like other Portland cement, made from limestone and clay. But a portion of the limestone and the bulk of the clay are subject to a double burning, being first passed through the blast furnace. Ninety per cent of the lime in the slag which they had used came from the limestone used as flux in the furnaces, while, roughly, 70 per cent of the silica came from the ores and 70 per cent of the alumina from the coal used in Scottish practice.

Cement clinker made from such slag and limestone, on account of its comparatively high alumina-to-silica ratio, gives generally a quick setting cement. But this property is capable of adjustment by the use of a suitable limestone, and by the addition of properly granulated slag. By these two expedients the setting time can, if required, be reduced to that of a medium of slow setting cement. Considerable objection is sometimes raised to the addition of granulated slag. The authors' experience had been that such an addition, up to 30 per cent of the total, not only regulates the setting time of the cement, but adds considerably to its tensile strength.

Not only is this improvement possible to the high alumina cement made from clinker, of which such slag and limestone are the constituents, but the effect is the same in the case of Portland cement made from the usual material. It had been stated by a very competent authority that German "Eisen" Portland cement was merely a genuine Portland cement adulterated with slag. This statement led the authors to make experiments to determine the result of adding granulated slag to a standard brand of Portland cement.

The results of tests made with the cement neat and with the cement mixed in the proportion of 70 to 30 with Wishaw blast furnace granulated slag are given in the paper.

There was one very interesting point to which they particularly wished to call attention. It is generally admitted that quick-setting Portland cement has less strength after a time than cement which sets more slowly. With their cement the high content of alumina makes it possible, contrary to the generally accepted theory, to use without fear of expansion, a greater percentage of lime in the clinker than is usual. The result of grinding such a clinker without any addition of raw slag is a very quick setting cement; but if suitable slag be added, such clinker gives a cement of reasonable setting time, which soon attains so great a strength that it has reached 1,300 lb. per sq. in. at 28 days.

This result was due to the presence in the clinker of a large proportion of "alite" consequent upon the high percentage of lime, which is greater than could be carried in ordinary Portland cement.

They suggested in conclusion that the quick setting and hardening was due to the beneficial effect of the

large proportion of hydrolysed aluminate upon the subsequent hydrolysis of the silicate of lime; further research into this point, which is peculiar to such high alumina cement, would be of interest.

Percy C. H. West also spoke on the effect of the addition of slag to Portland cement:

The origin of the discussion of this subject is to be found in the discovery of the cementitious properties of blast furnace slag and the production of a pozzuolanic cement from this material.

Michaelis, and about the same time Erdmenger, in the seventies and eighties observed the notable results obtained by the addition of pozzuolanic materials to Portland cement mortars, and these results were the first blows struck in a battle which is apparently not yet ended.

The publication of a circular by the "Vorwohler" Portland Cement Works, which were selling a Portland cement to which blast furnace slag had been added, describing their cement as a "Portland cement improved by the addition of silica in an active form" was the next important incident in the conflict.

The Association of German Portland Cement Manufacturers then began to take active steps to show that such additions were adulterations and nothing more. Dyckerhoff was one of the strongest supporters of this view. On the other side was Dr. Passow.

The work carried out on an extensive scale by the Royal Prussian Material Testing Station generally agreed with the experience of the speaker, that while a Portland cement of relatively poor quality was often improved, a first-class Portland cement did not have its mechanical properties improved by such an addition. Yet he found that with such additions products could be obtained quite equal in mechanical properties to many Portland cements.

There was one point which had not been recognized, namely, the sensitiveness of Portland cement to which such additions had been made to sulphates contained in aggregates with which the cement was used. Tests which had been carried out by him showed that in cold, wet weather, expansion of the concrete leading to most undesirable results was liable to occur where what may be described as an "Iron Portland Cement"—that is to say, a Portland cement to which slag had been added—was used; while, when Portland cement had been employed with the same aggregate and otherwise in similar conditions, such undesirable results did not occur.

The whole question had been energetically debated in the past, and for guidance in coming to a conclusion one must have regard to the prior publications concerning the matter.

Setting of Portland Cement in Relation to Engineering Structures.—Bertram Blount read a paper on "The Setting of Cement and Its Relation to Engineering Structures."

The author, after indicating the lack of exact knowledge of the nature and cause of the setting of cements of all classes, deals with the typical case of plaster of Paris, and points out that there is at present no true parallel between that and the more important case of Portland cement. He mentions modes of determining the setting of Portland cement and shows that these from the nature of the material cannot be exact, though sufficient for their purpose when such cement is in question. When, however, the setting of concrete has to be taken into account, the setting of the cement itself, though useful as a guide, is not conclusive, both because of difference of climate and the dilution of the cement with various aggregates, and he pleads for fuller investigation.

The subject was then thrown open for general discussion by those present.

W. D. Caroe gave some practical illustrations of the value of scientific investigations into the problems connected with cements and mortars from the point of view of the builder. One case illustrated was the stability of St. Paul's Cathedral. Another case led him to question the wisdom of excluding clay from mortar, as was done in the standard specifications adopted by architects. The expansion of cement containing slag needed investigation, as did also the chemical effect of cement upon stone. As ordinarily used, cement was often a source of great danger to old buildings.

A. Binns spoke of the setting of cement from the point of view of the constructional engineer. Initial set must not take place until the material is in position, but once in place the setting and hardening should be rapid. He referred also to the improvements in cements during the last 20 years, largely due to scientific research. The percentage of water used in concrete was of great importance, and it was not sufficiently controlled.

W. J. Cooper considered that Portland cement as made today could be free from any danger of future expansion. Researches on the time of setting should be carried out, with a view of improving setting qualities.

T. Martin Lowry, F. R. S., spoke of the difficulties that often arose on account of the setting into a hard mass of salts like ammonium nitrate. The fundamental cause was recrystallization, but in the absence of moisture caking did not take place. Both caking and disintegration were broad, general phenomena, and further research was called for.

F. C. Hemmings thought that to explain the setting of plaster of Paris it was sufficient to assume that the dihydrate was deposited in the interstices of the tiny particles and that the whole mass was not converted into dihydrate. In the case of crystalline salts the presence of a solvent medium was essential for setting. He gave some interesting details with regard to the conditions under which such setting took place, and also referred to some commercial applications of these problems.

Dr. W. Rosenhain, F. R. S., included the setting of metals in the more general analogous phenomena referred to by Dr. Donnan and the last speakers. Here also setting was caused by crystals adhering to one another very powerfully. The welding of metals was in that sense also a case of setting. He discussed the mechanism of crystal-adhesion, which was not due to frictional cohesion and attributed it to a film of amorphous material between the crystals which, possessing the properties of undercooled liquid, had no planes of cleavage or weakness. The theory was borne out by what had been said about the setting of cements and of crystalline aggregates.

Dr. C. H. Desch summed up the results of the discussion. The differences between the crystalline and colloidal theories had been shown to be largely a difference in terms. The essential difference between cases of recrystallization and of the setting of a colloidal mass lay in the solubility.

Winter Care of Contractors' Equipment

Equipment is frequently given scant attention when the contracting season closes. It is well known that abuse wears out nearly every implement more quickly than normal use.

Some suitable housing should be provided where machinery and tools can be stored and protected from the weather when not in use, and as an accessory to such storage there should be workshop facilities so that necessary repair and overhauling can be done during spare time in the winter. All wood parts of wagons and machinery should be gone over with a coat of paint, mixed with plenty of linseed oil, to prevent needless depreciation and deterioration and to thus prolong the usefulness of the implement. Special care and attention should be given to machinery having boilers or steam chambers so that they are thoroughly drained of water before freezing temperature prevails. If necessity compels that the best of machinery be stored in the open, working parts at least should be covered and protected as much as possible. Oiling or painting with machine paint will protect metal parts from rust. A suitable workshop will provide convenient quarters where smaller tools, such as shovels, picks, etc., can be given necessary repair.

Progressiveness and, to a certain degree, the competency of a contractor can be judged by the care which it is evident his equipment receives. With proper maintenance to the plant done during the spare hours of winter, there is no delay caused when the contracting season opens due to need of replacing broken parts and making other repairs that might have been done when the outfit was idle. An hour's work at the right time will save a day later.

Jeffrey Standardized Elevators

The Jeffrey Manufacturing Co., Columbus, Ohio, new Catalog No. 244, which has just been completed, shows the advantage of using Jeffrey Standardized Elevators and has other important data that will be of interest to our readers.

This book contains 40 pages devoted to details of elevators selected out of numerous styles used in the handling of a wide range of materials in practically every industry of the country, and known as Jeffrey Standard Elevators.

A page is given to each Standard Elevator which is illustrated, both in perspective and in line drawing giving dimensions. There is also an illustration showing the chain and bucket used in that type of elevator, and at the bottom of each sheet is given a full list of all specifications applying to that particular elevator.

The numerous examples and subjects which have been thoroughly outlined in this book, enable the prospective purchaser to readily select the proper Standard Elevator to meet his requirements, thus saving the time and expense heretofore required in making layouts and drawings for his own particular needs. The purchaser is further benefited by quick delivery made possible by placing Jeffrey Standard Elevators upon a manufacturing basis.

The catalog is now ready for distribution to the trade. Write for copy.

All About Dredges

If you want to be informed concerning the latest thing in dredges, get a copy of the catalogue issued by the Bay City Dredge Works, Bay City, Mich., which manufactures dredges of the walking type, the track type and the floating type. There are pictures plentifully distributed through the book showing these different types of dredges at work. They can be used, it is stated, for all kinds of jobs from narrow tile trenches to ditches with a top width of 50 feet, and they serve for a great variety of ditching, irrigation and large trench work. They are of steel construction.

Construction Methods Employed in Building the New Intake and Remodeled Reservoirs of the Oshkosh, Wisconsin, Water Works

By T. B. Jorgensen, Resident Engineer, Oshkosh, Wis.

In connection with the recently constructed water filtration plant the city of Oshkosh awarded a contract for the construction of a new intake and a connection between the old intake and the new filter plant. The plans and specifications for the intake were prepared by Col. Henry A. Allen, of Chicago. J. Rasmussen & Sons Co., of Oshkosh, were the contractors.

The New Intake and Crib

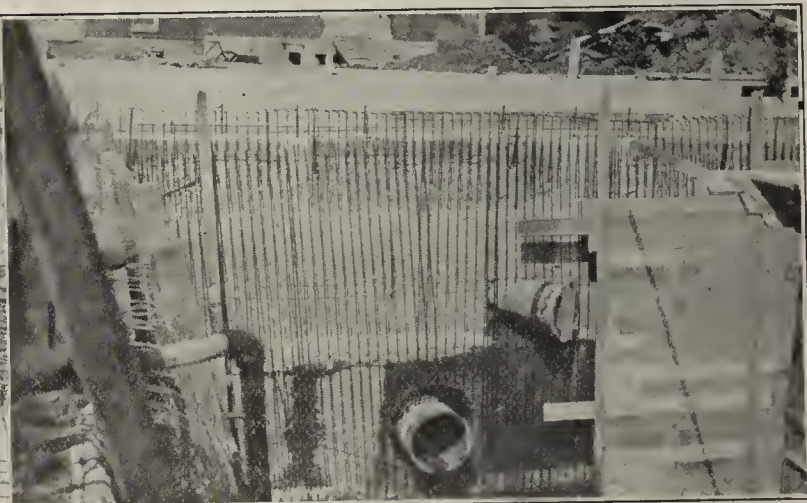
The new intake consists of about 300 ft. of piping connecting the shore line with the suction well in the filtration plant, and 1,200 ft. of piping from the shore line out in Lake Winnebago. It is constructed of 24-in. cast iron piping, Class B, bell and spigot, with three-ball joints, in the lake section, for expansion.

At the extreme end is constructed a submerged concrete crib, supported on pile foundation, with its high point 9 ft. 8 ins. under low water level. The work was started in the early fall of 1917 with excavation for the crib.

It was our original intention to build a cofferdam around the location of the crib and then build the concrete crib right in place on its pile foundation. Con-

crib on top of the cofferdam by placing stringers supported by the sheeting and laying a solid floor of 6-in. timber, upon which we built the forms for the crib, placed the reinforcement and the necessary castings and poured the concrete. After the crib was completed we lowered the entire crib, which weighs about 30 tons, with six threaded rods, supported on nuts, which again were supported by heavy timber horses. The operation of lowering this weight was very simple, merely unscrewing the nuts evenly on all six rods until the bottom of the crib struck the pile foundation.

The fact that we constructed the crib on top of the cofferdam made it less expensive to construct and gave us a better job than we could have expected inside the cofferdam. By the time the crib was completed the ice came, covering up the entire lake. As the city was in urgent need of this intake, we started to lay the pipe from the ice; that is, we located our dredge at the shore point of the line and kept a channel open sufficiently far ahead for our progress. As the pipe is practically level, we had about 12 ft. excavation next to the shore, gradually diminishing to about 2 ft.



Views of Remodeled Reservoirs of Oshkosh Water Works.

Left—Reinforcement in Flat Slab Roof Over South Reservoir (Old Settling Basin). Right—Formwork for Lining in North Reservoir with Triangle Mesh Reinforcement.

sequently the contractor built the cofferdam of 3-in. plank in three layers, so that the two outside layers covered up the joints of the center sheets. It was then covered with canvas on the pressure side and banked up with dirt to about half its depth. Rigid framework braced the wall from the inside.

The sheet piling was driven to refusal in quicksand mixed with clay. Upon pumping out the cofferdam we discovered that the bottom would not hold, as the water broke through, carrying with it sand, thereby making it impossible to keep our excavation low enough for the bottom of the crib. After driving another cofferdam round the first one, with even a deeper penetration, we were not able to maintain our excavation. In order to eliminate the upward water pressure on the bottom inside the crib and to enable us to maintain our excavation, we filled the cofferdam and excavated to the proper elevation with the dredge, after having removed the inside bracing, that interfered with the excavation.

Crib Construction Difficulties Solved

We then proceeded with the construction of the

next to the crib. The pipes were lowered in sections of three and four lengths, with all joints that were made on shore of poured lead and the joints made under water were caulked with lead wool, with the exception of the flexible ball joints, which were flanged.

The advantages we observed by placing the line from the ice were that we were independent of weather conditions and the rough lake on windy days and that no extra barge was required for the handling of the pipe, as the pipe sections were hauled out on the ice and placed alongside the channel, where they were picked up by the dredge boom and lowered into the excavated bed. The contractor managed to reduce his cost of keeping the channel free from ice by cutting the ice and selling it to a local ice company.

Where the pipe line connects to the crib there is a 24-in. valve, and this was closed during the final tests. These tests were conducted by putting the entire line under a pressure of 30 lbs. per sq. in. from an elevated tank in the filter plant. A 10-in. pipe is connected from the riser pipe to a point on the intake immediately outside of the suction well in the filter plant, into which the intake discharges.

After having put the line under pressure several times for the purpose of discovering any leaky joints, which were recaulked, we finally got a perfectly tight job holding a pressure of 30 lbs. per sq. in. At the acceptance of the crib and intake the writer put on a diving suit and inspected the line and the crib.

Remodeling of Old Reservoir for Increasing the Storage Capacity of Filtered Water

At the time the new filtration plant was contemplated contracts were also let to remodel and cover up two storage basins which were used by the old water works, one for clear water storage and one for a settling basin. Their respective capacities are 1,300,000 gals. for the clear water basin and 700,000 gals. for the old settling basin.

The basins were both in a very poor condition, with cracked concrete walls without reinforcement. However, they were heavy enough to withstand the water pressure as a gravity wall. The work started first on the old settling basin, which was the worst of the two, and about 2 ft. lower than the other basin.

This is now completed and filled with water, while the work on the other basin is still under construction. The inside face of the walls was stepped off in four steps and the depth of 14 ft. was increased to 17 ft.

top of the roof. The same construction method is now being used for the other basin.

As the floors were in poor condition, an extra 4 ins. of concrete was placed, reinforced with light triangle mesh. When the reservoirs are completed the earth level around the new filtration plant extended over the two basins will entirely conceal them, and at the same time will aid in keeping the water supply of the city cool in the summer.

Potash Production Should Be Fostered by Government

N. S. Potter, Jr.

Vice-President-General Manager Michigan Portland Cement Co., Chelsea, Mich.

We are very much interested in the subject of potash production in this country, and believe the development of the potash resources of the United States should be fostered by the Government in every way possible.

We are not familiar with the War Minerals Act, and would be very glad to have you either send us or advise us where we can procure a copy. Upon receipt of the information from you as to the plan which



Views of Remodeled Reservoir of Oshkosh Water Works

Left—Construction in Progress in North Reservoir (Old Storage Basin). Note Dowels in Old Wall and Baffle Wall Along Center Line of Reservoir. Right—Interior View of Old Settling Basin After Being Roofed and Ready to Store Filtered Water.

To put these walls in a water-tight condition we gave the entire surface a 6-in. concrete lining, with heavy triangle mesh reinforcement. Dowels were placed in the walls about 4 ft. apart, also on top of the old walls. The concrete mixture in this lining was 1 part cement, 2 sand and 4 of roofing gravel mixed with smaller size crushed stone. The lining reinforcement was bent over at the top extending up to the height of the extension of the wall, which was poured in conjunction with the lining.

The roof of the basin is supported by columns about 16 ft. centers, and is of flat slab construction. Baffle walls were poured in between columns for the purpose of maintaining circulation of the water at all times and eliminating all dead space. The old piping is used and so arranged that each basin can be used independently. In the roof are placed manholes and ventilating shafts covered with a casting. As both basins are going to be covered with 1 ft. of dirt, the ventilating shafts are elevated to about 4 ft. over the

the Administration proposed we will be glad to take it up with our Senators and Congressmen, urging their co-operation.

Economical Handling of Coal and Ashes and Reserve Cold Storage

Link Belt Co., which has its main offices at Chicago, has issued a very interesting book on the important subject of "Economical Handling of Coal and Ashes and Reserve Coal Storage." This book, of 52 pages, covers very fully the economical handling of coal and ashes in utility and industrial plants. Numerous half-tones and line drawings are included showing a number of power plants, coal weighing apparatus, coal handling equipment and many types of coal bunkers. Some cost data is also given. Coal and ash handling and the storage of coal are discussed in a thorough manner. This book is a valuable contribution to the subject and is recommended to all operating engineers.

Cracking of Concrete Roads and Its Prevention by Reinforcing with Steel

The most serious defect in a plain concrete road slab is its tendency to crack. An interesting discussion of the underlying causes of this cracking, together with a description of the methods used to prevent or to control this tendency, is given by Mr. W. B. Sawyer, Jr., in a recent issue of *Western Engineering*, to which we are indebted for the matter in this article.

Transverse Cracks

Expansion of Concrete Because of Change of Temperature.—The coefficient of expansion of concrete is 0.0000055 per degree F. For every degree F. rise in temperature concrete will expand 0.0000055 times its length. If the concrete slab were resting on a frictionless plane this movement would cause no stresses in the slab, but unfortunately we do not have any such ideal conditions. There is a definite amount of friction between the surface of the sub-base and the surface of the concrete slab above it. This varies with the kind of base and the degree of roughness of surface. The friction between the two surfaces resists any movement. When movement does occur, the resistance of friction causes tensile stresses in the concrete. When these stresses become greater than the tensile strength of the concrete, cracks occur.

Change in Moisture Content.—Another cause of cracking, and probably the most important one, is change in the moisture content of the concrete. When concrete is hardened under water or under moist conditions it expands slightly. The expansion varies somewhat with different mixtures, and according to tests is from 0.02 to 0.05 per cent of the length. When concrete is hardened in air and the moisture is evaporated it will contract. The shrinkage may be as much as 0.08 per cent of its length. To counteract this contraction by an equal amount of expansion, because of a change in temperature, a rise of 145° F. would have to take place. This is illustrated by the recent statement of the United States Bureau of Standards that concrete roads expand in winter and contract in summer because of increase or decrease in the moisture content. This shrinkage, caused by the drying of the concrete, occurs when the concrete is not fully hardened and its tensile strength is low, probably not over 50 lb. per square inch; therefore the stresses developed by only a slight movement of the slab at this time will produce cracks. These are the characteristic transverse cracks which occur in plain concrete pavement at intervals of 25 to 35 ft.

Causes of Longitudinal Cracks

Non-Uniform Bearing on Sub-base.—This may be the result of unequal settlement of fill or similar causes. The road slab is not designed to carry its load as an ordinary floor slab or beam. If the slab is left unsupported, either at the center or sides, the load imposed will often cause longitudinal cracks.

Expansion or Contraction of Sub-base Because of a Change in Moisture Content.—The most troublesome sub-base in this regard is the adobe of central and southern California. This soil absorbs water, causing considerable expansion, then upon drying shrinkage takes place and opens the familiar adobe cracks. The shrinkage stresses are usually great enough to cause cracks in plain concrete resting upon the sub-base. The supporting power of the sub-base is the important element in the consideration of longitudinal cracks. Even with the most careful construction methods it is hard to get a uniform and homogeneous

sub-base that is dependable as far as supporting power is concerned.

Consideration of the various causes producing cracks in unreinforced concrete shows that the most important and most frequent are, first, shrinkage of concrete when hardening, causing transverse cracks, and, second, insufficient support of sub-base, causing longitudinal cracks. By increasing the tensile strength of the concrete slab it has been found that these cracks can be either entirely eliminated or else so controlled that they are no longer a serious defect. This increased tensile strength is gained by the addition of steel reinforcement.

Placing Reinforcing Steel

Prevention of Longitudinal Cracks.—Two systems for placing the reinforcement are now being used in California with success. The first system is for eliminating the longitudinal cracks. The steel is in the form of wire fabric in strips about 5 ft. in width and in length equal to the width of the road to be paved. The main or longitudinal wires are placed at right angles to the center line of the road. The weight of fabric varies from 22 to 35 lb. per 100 sq. ft., the average being about 31 lb. The method used in placing the fabric is simple and has been found not to hinder or retard the mixing and placing of the concrete. The fabric is placed on the job in proper lengths. These strips are placed one at a time upon the prepared sub-base directly behind the mixer, between it and the already finished pavement. The concrete is then poured in the usual manner and allowed to flow over the mesh. After the shovelmens have properly distributed the wet concrete to the required thickness a small hook is used to raise the wires to the center of the slab. Care is taken to make sure that the steel is embedded approximately in the center, as, of course, it would be useless if left resting upon the sub-base. Two extra men per gang are needed for handling and placing the fabric. This method of reinforcing has proved satisfactory. It eliminates the longitudinal cracks.

This system of reinforcing has been used extensively by the State Highway Commission of California. They have found it especially useful in preventing longitudinal cracks in pavement that is laid over adobe sub-base.

Controlling Transverse Cracks.—The second system for placing the mesh is designed to control the transverse cracks in the concrete and to increase the distance between them. Some highway engineers control these transverse cracks by placing contraction joints every 25 to 35 ft. Such joints are the weakest feature of the concrete pavement. No matter what type of joint is used, they must be given frequent and careful attention to prevent rapid deterioration of the adjacent pavement. They should therefore be separated as far as possible. This is accomplished by placing the main or longitudinal wires of the reinforcing material parallel to the center line of the road. The method employed is similar to the first system described, with this difference—the mesh is not cut into strips, but is placed on the job in rolls several hundred feet long and of the proper width. These rolls are placed directly behind the mixer. They are unrolled as the mixer is moved forward, thus making the longitudinal reinforcement continuous. The concrete is poured and the steel is raised by hooks to the center of the slab as in the other system. Two or three rolls are used, depending on the width of the road. By giving a small lap on each width, reinforcement at right

angles to the direction of the road is obtained. This prevents the longitudinal as well as the transverse cracks. The advantages of this system are obvious. It eliminates many expansion joints, prevents longitudinal cracks, and is somewhat cheaper than the first system. This system has been used with great success in Tulare County under the direction of Byron Lovelace, County Highway Engineer. One stretch of road in particular is worthy of mention. In building the main highway near Exeter a great deal of adobe soil was found in the sub-base. It was therefore decided to reinforce the entire section. The system described above was used. Although the contraction joints were placed about 600 ft. apart, not a single crack can be found in the mile of highway. Experience with this system of reinforcing has shown that the distance between contraction joints can be made as much as 300 ft. with safety, thus allowing joints to be placed at midday and at the end of a day's run, where the daily run is about 600 lin. ft.

Cost of Reinforcement.—The cost of the reinforcement varies, of course, with the situation of the work and the weight of reinforcement. Basing costs on contract work in central California and with steel weighing about 30 lb. per 100 sq. ft. of mesh, the cost of the material delivered is approximately \$1.65 per 100 sq. ft. Adding to this \$0.10 per 100 sq. ft. for hauling and placing gives a total cost of \$1.75 per 100 sq. ft. for reinforcement in place. The cost per mile for reinforcing a road 15 ft. wide is \$1,386. The annual interest charge, therefore, per mile is about \$70. This annual cost is much less than the cost of maintenance and repair because of the cracks in plain concrete pavement, and is also largely offset by the elimination of the first cost of nearly all of the contraction joints. A light slab properly reinforced will outlast a heavier slab without reinforcement. Although the slab should be heavy enough to carry the traffic safely, in cases where first cost is of primary importance, better results can be obtained by using a relatively thin slab with proper reinforcement than a slab an inch thicker without it. Under such conditions the first cost is approximately the same in both cases.

The use of steel reinforcement in concrete pavement is theoretically correct, as it furnishes tensile strength to the concrete and enables it to resist stresses that would otherwise produce cracks and which, even with an asphalt top, either reduce the life of the pavement or else increase the expense for repairs. Also it furnishes additional strength to resist forces caused by adverse conditions in the sub-base. In actual practice, not only in California, but in practically all of the other states both East and West, it has proved its efficiency. Its use has been demonstrated to be economically sound and in the interest of true economy.

Cement Exports

According to the Department of Commerce the following is a statement showing the imports and exports of cement, by countries, during October, 1918:

Imports		
Countries—	100 lbs.	
Canada	161	\$153
Exports		
	Bbls.	
Iceland	330	\$ 1,016
Bermuda	1,255	3,754
Canada	1,806	6,677
Costa Rica	100	375
Guatemala	2,480	8,287
Honduras	963	2,941

Nicaragua	210	944
Panama	1,021	7,760
Salvador	1,443	5,111
Mexico	11,135	31,652
Newfoundland and Labrador...	873	2,587
Barbados	492	1,775
Jamaica	855	2,455
Trinidad	2,989	7,725
Other British West Indies.....	1,260	3,879
Cuba	35,277	111,849
Danish West Indies.....	490	1,979
Dutch West Indies.....	485	2,117
French West Indies.....	885	2,773
Haiti	2,522	8,661
Dom. Republic	2,410	8,241
Argentina	650	1,985
Bolivia	2,525	7,196
Brazil	1,070	2,620
Chile	6,834	28,764
Colombia	1,712	5,429
British Guiana	11,041	31,358
Dutch Guiana	706	2,375
Peru	7,575	24,326
Venezuela	611	1,817
Dutch East Indies.....	10	50
Turkey in Asia.....	250	750
Belgian Kongo	2,432	8,282
British West Africa.....	500	1,540
Madagascar	300	1,250
Total	105,497	\$340,300

Declares Concrete Is Only Road Material

It Is the Economical Material of the Future

Chairman W. B. Conoley, of the board of county commissioners, Valdosta, Ga., believes that the good roads of the future must be made of concrete, and that there is no other material that will equal concrete for economy and durability. Since he has been at the head of the board Mr. Conoley has given close attention to the work of making good roads in Lowndes County, studying the question from every standpoint.

After collecting a considerable amount of information from high authorities he gives it as his opinion that the roads of the future must be made of concrete if they are to be built with a view to utility and economy. It is his opinion that after business affairs reach normal conditions following the close of the war, concrete can be bought at such a reasonable figure it will be the cheapest, good and lasting material to be had. He says that a number of counties can combine and buy the cement at a most reasonable price under normal conditions and that this will enable the people to have roads built of the only material that will last. This will cut down the great expenses of upkeep which follows roads built of brick, asphalt and all other materials.

Speaking of the matter this morning Chairman Conoley said that according to the information he had been able to secure from the very best of authorities, concrete was the only available material from which roads could be made where their durability could be guaranteed, provided they were put down in a correct manner. All other materials wear away under ordinary use, and cost tremendously to repair, and are never so good any more, while concrete will last more than a lifetime with no expense for repairs.

In this opinion he is joined by many people and it is believed that sentiment in favor of such road building for the future is rapidly centering on this reliable material.

The City of



20 THOUSAND



"COMMANDER"
Transmission Belts

"LONGLIFE"
Conveyor Belts

"MARATHON"
High Speed Belts

"COMMANDER"
Pneumatic Hose,
Steam, Suction,
Water, Mill, Boiler
Washout, Oil, Acid
and Chemical Hose

"WHITE KING"
FIRE HOSE

SUPPOSE every man, woman and child in Sharon, Pa., for example, suddenly stopped their everyday occupation and started making rubber goods.

With a grinding of brakes and a hissing of compressed air every bit of industrial activity in that flourishing town would come to silence. Factories close—street cars halt—newsboys hush their strident cries—business offices pull down the blinds—and women turn from oven and tea-table—

And all start making, tires, boots, water bottles, hose, surgical goods and those thousand and one blessings that the Creator made possible when he put that strange white liquid just under the bark of a little tree down in South America.

The Goodrich Factories at Akron—one gigantic single group of sixty-three buildings—constitute a force far beyond that represented by the busy little city we have just used as an example.

It is literally a city—with its own postoffice, restaurants, and physicians; and it has police and fire protection and free schools just like any other town its size.

And the one absorbing idea, facing every employee each day, through training, suggestion and even internal

GOODRICH



INHABITANTS

advertising, is "Quality First." No less could have brought this organization to its present size and perfection—could have made it more enduring than the very steel that supports its mammoth bulk.

Of all the products turned out by Goodrich none have greater interest to the American Nation today than Mechanical Goods—Belts, Packing, Hose, Molded Goods.

We have just emerged from the greatest struggle in war's bloody chronology. It was primarily an Industrial War. Greater efficiency was needed to win. Belts must carry even heavier loads—hose must stand up under even severer usage and so on.

Goodrich experts realized the need—and responded. We made advances and improvements in months that ordinarily required years—even among the rubber world's keenest minds. And this newer efficiency is permanent. It is the gift of Goodrich to American Industry. We claim that you will obtain from these Goodrich Belts, Packings, etc., an even greater efficiency than they yielded before.

Our experts are ready to serve you.

The B. F. Goodrich Rubber Co.

The City of Goodrich—Akron, Ohio



Gaskets, Tubings and
Valves of all kinds

Diaphragms

"Superheat" and
Square Hydraulic
Packing

Mats and Matting

Wires and Cables

Boots and Shoes

Tires for automobiles,
bicycles motor
trucks, areoplanes,
etc.

MECHANICAL RUBBER GOODS

Labor Saving Device for Finishing Concrete Pavements

By J. C. Hills

County Engineer, Bellingham, Wash.



Using Finishing Board on Blaine-Ferndale Road in Whatcom County, Wash.

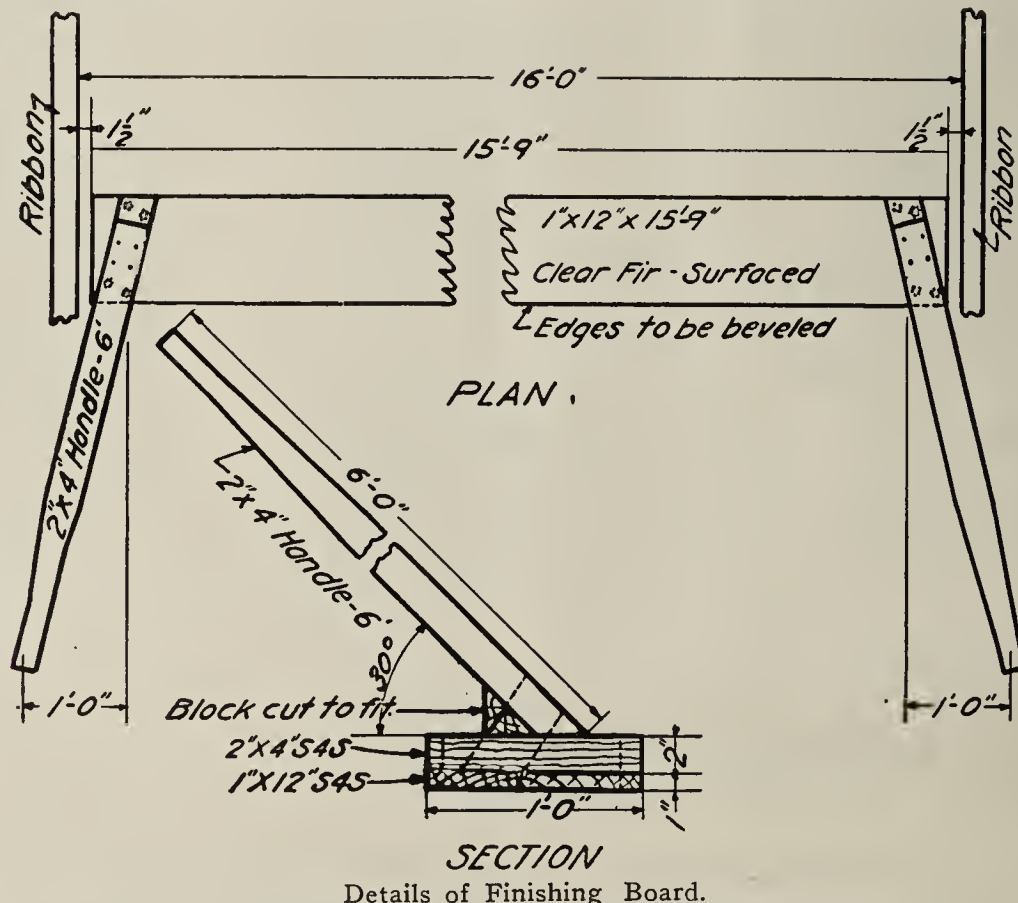
Labor shortage this year has made it necessary to extend the available man-power on concrete pavement construction as much as possible. To obtain a satisfactory surface finish, after the rolling of the pavement has been completed, a finishing board has been developed which is used instead of the canvas belt, and which is giving hoped-for satisfaction. This board is made as shown by an accompanying drawing, and a picture illustrates the method of application. As soon as the rolling has been completed, the finishing board is pushed along the pavement by two men. This operation is found to produce as satisfactory a finish as is given by the use of a belt, and in a shorter time. With two or more trips back and forth over a section, the surface is made perfectly even with-

ly well graded gravel, up to three and one-half inches in size. When the concrete is spread on the damp subgrade by the shovelers and the template, the application of the concrete paving roller in the usual way forces the larger aggregate down, and leaves a surface which is easily completed by the use of the finishing board. We have found that the use of coarse aggregate graded up to larger sizes ($3\frac{1}{2}$ inches maximum) than are sometimes specified, and just as little mixing water as is possible to get along with, together with a full sixty seconds in the mixing drum, produces the best concrete for highway and street pavements. We now have about 25 miles under construction, and completed 9 miles last year. Inability to obtain enough contractors prevents us from building as much concrete highway this year as the taxpayers desire and are ready to pay for.

To date, we have either built or contracted for 53 miles of one course concrete pavement.

Softening Water for Boilers

William B. Scaife & Sons Co., Pittsburgh, Pa., have issued a handsome new catalog measuring $8\frac{1}{2} \times 11$ inches and containing 75 pages of interesting and instructive matter on the softening of water for boilers and manufacturing purposes, and the simple apparatus for doing this which the company manufacture. The catalog is profusely illustrated, showing the several systems in detail, and their general appearance when installed in a plant. The methods of operating are explained and the purifying processes are thoroughly described. In addition to this are several valuable tables giving information regarding water and its uses.



out ridges or hollows, and has the required degree of grittiness to prevent skidding.

We use only sufficient water in the concrete to produce a batch that will barely leave the drum when dumped, and the concrete frequently has to be pushed down the chute with shovels. The aggregate is large-

Among others is a table of chemical analyses of river and well water from different parts of the United States; and a table of units by which analyses can be reduced to a common basis for comparison. Engineers generally will find much of interest and value in this catalog.

Materials for Construction of Large Government Project Hauled With Fleet of Fifty Motor Trucks

Transportation speed has been one of the greatest factors in the prosecution of the world's war by the United States. Whatever has been undertaken has been with the expectation that the needs of the government would be more than met. The country, once it engaged in war, made preparation to meet every demand made upon it. Operations were planned so much larger than was ever before conceived that few were qualified to judge their magnitude from proportions and dimensions usually dealt with.

The United States without hesitancy required of its engineers and its industrial workers more than was ever before asked of a people by a government. With assurance that would have been regarded as visionary in normal times the undertakings were begun and carried through with results that justified every plan. In fact proposals that were previously regarded as impossible became the commonplace.

It was engineering and the concerted work of millions that made these results possible. It was the skill and the earnest endeavors of men whose country never has met defeat that carried these undertakings to finished works, and yet all depended upon transportation, which has been more highly developed in America than in any other country of the world.

Greatest Need Is Transportation

Events have proven that wonderful accomplishments are possible by continuous work and adequate supplies of labor and materials—and more necessary than all else is transportation, that there shall be no cessation of production or loss of time. During the progress of the war the unparalleled constructive genius of the American people has been manifested thousands of times, and in no instance has there been reason to believe that the limitations have been reached, although the people have been forced to extremities that would not ordinarily be considered as necessary or, in many cases, even reasonable.

But winning the war has developed resourcefulness and capacities in men that would not have been dreamed of in industry in time of peace. The war time activities have proven that the future will present propositions that will be gigantic and which will be consummated as easily and as quickly as those that were stimulated by the fire of patriotism and the well nigh marvelous organization that has been created to meet this national exigency.

Wondrous Works of Industry

Little has been told of the almost wondrous works of industry because of obvious reasons. But there is no question whatever that when the history of the

world's war is written from the viewpoint of industry there will be quite as many feats of real patriotism as may be recounted by those who were on the battlefields, in the trenches, in the air or on the sea. And this statement is not meant to discount the magnificent courage and valor of Americans in actual conflict, but to emphasize the splendid unity and concerted endeavor of those who have labored for those who were fighting for a world's peace.

That its armies and navy might be supplied with ammunition the United States planned the erection of several plants for making explosives. Because of the danger incidental to all works of this character the locations for these were chosen as remote as possible from towns and cities, and yet where conditions were suited for the receipt of raw material and shipment of finished products. Among other factors considered was that of having the sites sufficiently distant from the coast as to be reasonably secure from an enemy attack in war, and protected so far as possible from an invader by natural barriers that can be fortified and defended in the event of need.

Mammoth Plant at Nitro

The first plant projected was built on farming land in the Kanawha river valley in West Virginia, 18 miles west of Charleston, and the name given, Nitro, was typical of the operations to be carried on there. The detail of construction is immaterial, but the proportions may be judged from the cost, which is placed at \$45,000,000, and this includes the expense of building the works and the several thousand homes for workers, with the necessary structures for administration and welfare of the employees.

The site of Nitro was a number of farms in a river valley that had been under cultivation for years, and it lacked everything that was essential for a place of work or residence. On January 1, 1918, the operations of constructing it were begun, and 10 months later it was a city of 17,000 people, with the shops and mills complete and productive, with 2,000 or more residences, and besides these, roads, streets and sidewalks, water, gas and sewerage systems, lighting and telephone and telegraph circuits, and railroad track and terminals, all built substantially and equal to what would be found in any community, though possibly lacking the finish that comes with occupancy and desire for surrounding ornamentation of homes.

Construction Is Permanent

This was not a mushroom collection of shacks. The buildings were all permanent and were equipped with practically all the conveniences that could be found in



A Section of the Fleet of Motor Trucks, Supplied by the Heavy Haulage Co., New York, N. Y., to the General Contractors, the Thompson-Starrett Co., for Work at Nitro, W. Va.

any long established place of residence. While the big munition plant was built for the production of explosives for use in the war, the object is to have it always in readiness for operation so that, should there be later on need of producing ammunition material, it would be in readiness. For this reason the city of Nitro is well built and the character of materials used was the same that would be used for similar construction in any industrial community.

Construction Is Substantial

For instance, all of the buildings for manufacturing are substantial, located as much removed from the residential section as is practical, with a view of minimizing the danger from accidental explosion, and the houses are four, five and six-room bungalows, with practically every facility and convenience that can be found in the homes of industrial workers constructed to general designs and not to meet the ideas of individuals. The residences are located with reference to permanent streets, and sanitation required water distribution and disposal of sewage. Convenience necessitated the installation of gas mains and the erection of electric light, telegraph and telephone circuits.

While the buildings as a rule are detached and separated as the needs of safety require, some of the structures of the works are very large. This applies especially to the power houses, which are equipped with engines to develop 47,000 horsepower.

The city is on a government reservation 18 miles west of Charleston, and is on a bottom land between a range of hills and the Kanawha river. The tract under government control is somewhat more than $3\frac{1}{2}$ miles long and about $1\frac{1}{2}$ miles wide, the river bounding one side and the hills the other. The construction of the city was planned as quickly as the engineers believed would be possible, and conditions required that the work be begun in mid-winter—a winter that was the most severe of record in America.

efficient in the history of a concern known the world over for the success of its industrial operations.

While practically unlimited resources were at the command of the government and the contractor, the army of workmen contributed quite as much to the success of the operation as did the engineering, and the physical and climatic conditions that would ordinarily have been obstacles were not causes of retardation.

The material for the construction of the works and the dwellings and the various buildings necessary for the completed plant and the city of workers, as well as temporary structures and the underground and overhead systems, was brought to the reservation and first stored and next distributed to the places where they were used. This necessitated transportation in large volume and practically to every part of the reservation.

The Transportation Units Used

Besides this haulage there was excavating seemingly without end, filling and grading. In a general way this had best be dealt with by statement showing the units, which included 50 power trucks, 650 teams of horses, 17 yoke of oxen, 30 small tractors of caterpillar type, which were used with trailers very frequently; six standard gauge locomotives, a number of narrow gauge locomotives, a river steamer, 11 barges and a derrick boat.

These units were assigned for work that could be best done by them and the trucks were utilized for the work that required speed and large volume. Yardage and tonnage of compelling magnitude will afford some idea of the work done with the machines, but a true realization of what is stated in various terms and totals could not be possible unless one were to make a personal visit, and not even then unless one were informed of the original conditions.

The transformation was of lands on which crops were grown to the sites of workshops of varying types



Under These Loading Bins There Was an Almost Continuous Stream of Trucks During the Working Hours, Showing the Value of Careful Preparation and Systematic Operation.

Continuous Work Planned

The preliminary work was the building of a railroad to the reservation, with spurs and sidings, and following this roads were constructed, which were developed and perfected according to the requirements of the work as it progressed. The working plan was proportionate to the project in the sense that all the equipment that could be used was available and the workers were numbered by thousands. Operations were carried on night and day, a part of the time practically continuously, and at all times at a pace that was only possible by the splendid co-operation of an organization that may be said to be the largest and the most

and dimensions; huge boiler houses, administration buildings, offices, barracks, magazines for explosives, a hospital, a railroad station and thousands of homes. And these are referred to as units when they in themselves each represent varying ratios of materials, often of large volume, handled and rehandled in the course of construction.

Some Items of Materials

The following are some of the items of materials, but these do not fully represent the work of hauling and distributing them, for these were, in some instances, received and stored and requisitioned and delivered to places of construction, necessitating several

handlings, and the excavating and filling it not even stated:

Brick	30,950,000
Concrete, cubic yards.....	185,000
Lumber, feet	75,079,000
Sewer pipe, four to 12 inch, lineal feet.....	199,160
Segment block, lineal feet.....	46,356
Cast iron water pipe, lineal feet.....	343,200
Wooden water lines, lineal feet.....	65,500
Plumbing fixtures	14,340
Valves	80,000

In addition the freightage included materials for more than 12 miles of macadamized roads, several thousand tons of machinery, household furniture for 2,000 four, five and six-room bungalows; materials and equipment for 10 mess halls, seven stores, 22 stands and a large administration building.

Operating Speed Imperative

That the work should go on without cessation there was necessity of all requirements being met. Speed was imperative and this meant that the haulage work must be highly systematized. The main contractor was the Thompson-Starrett Co., and the trucks were owned by the Heavy Haulage Co., New York City, of which George H. Pride is president. The Heavy Haulage Co. made contract with the main contractor to provide the trucks at a stated price a day, which included a repair shop equipment, a stock of spare parts for repairs, a competent master mechanic to operate the repair shop and a force of expert mechanics and an office manager and a superintendent of operations.

The Heavy Haulage Co. provided 35 two-ton truck chassis equipped with hydraulic hoists and two-yard steel bodies, five five-ton truck chassis with hydraulic hoists and three-yard steel bodies, and ten two-ton truck chassis with platform bodies.

The Thompson-Starrett Co. hired the truck drivers and furnished the fuel, lubricants, supplies of all kinds for the trucks and provided the repair shop and office buildings necessary. One of the conditions of the contract was that the drivers should clean, oil and grease the trucks daily, this being done after the day's work had been completed.

Kentucky Crushed Stone Men Organize

Following a two-day session of prominent stone crushers of Kentucky at the Seelbach Hotel, Louisville, the Kentucky Crushed Stone Association was launched on November 27. The organization is composed of quarry operators who operate crushing plants for furnishing crushed stone for building, railroad, highway and other construction, and any crusher operator is eligible to membership.

The plans of the association are to unite the trade on a firmer basis. It is planned to bring about greater co-operation, and better maintenance of markets, better methods of quarrying, interchange of information concerning machinery and quarrying in general, and such matters as freight rates, deliveries, coal supply, general supplies, labor, and selling terms.

The meeting was called by R. Brink Tyler, head of the Tyler Building Supply Co., R. B. Tyler Stone Co., and Banner Coal Co. Mr. Tyler had originally planned holding the meeting in compliance with the wishes of the War Service Committee on Mineral Aggregates, which was formed at Washington some time ago with the object in view of assisting the Government in winning the war. While this necessity has disappeared to some extent, Mr. Tyler, who is committeeman for Kentucky, felt that such an organization was needed in

Kentucky, and would result in closer co-operation of the quarrymen. It is believed that much good can be done through getting the members of the trade together frequently, and discussing the best methods of marketing and producing.

Seventeen crushing plants were represented at the meeting. A temporary organization was launched which will be made into a permanent body at another meeting to be held at the Seelbach Hotel.

Rego Welding and Cutting Apparatus

A number of important improvements are embodied in the Rego welding and cutting apparatus, manufactured by the Bastian-Blessing Co., of Chicago. The one-piece nickel-copper tip, which features both the welding and cutting machines, saves tip renewals and insures good operation. The renewable mixing chamber in the cutting apparatus permits of new chamber-threading into the head, if it is impossible to regrind the tips to a proper seat because of accumulated dirt. The location of all valves outside makes them easily reached for repacking or regrinding, if necessary.

The stem of the needle valve threads into a sleeve—not into the casting; the sleeve slides into a valve casting. This sliding sleeve grinds itself to a proper seat each time the valve is closed and reopens easily. The long leverage on the oxygen control insures opening of the valve without strain upon the operator, while the positive locking device permits of easy and steady operation and helps maintain a smooth cut.

One of the most valuable features of the Rego apparatus is the absence of backfire or flashback. This allows the tip to bear directly on the metal, smothers the flame, and cuts or welds much more effectively than if the tip were held far enough away so that the flame just touched the metal. It also allows the cut to be started in the body of the plate instead of the edge, and bore through regardless of the thickness or dirt obstruction. Further, cutting can be done in confined spaces, where the head is subjected to considerable heat or where there is little escape for the heat except against the tip, which in the ordinary torch usually causes a flashback.

In the welding apparatus the gases are mixed in the tip in exactly the right quantities at the right pressures and in the proper chemical proportions to secure a neutral flame, maintaining at all times balanced pressures of oxygen and acetylene. Another important feature of the welding machine is the soft welding flame, which melts the metal without blowing it away. This, combined with balanced pressures, produces a weld free from oxides and of great tensile strength.

Quick heating of the metal, the saving of time and gas by the absence of flashback, uniform pressure, and sturdy construction make for economy in the use of Rego apparatus.

Ohio Sand and Gravel Producers Hold Meeting

Twenty members of the Sand and Gravel Producers' Association of Ohio were in attendance at a meeting held recently for the purpose of considering concerted action in an attempt to secure reduced freight rates on sand and gravel.

Other questions considered included the policy in the matter of assisting the state highway commission and county officials in working out a systematic program of highway construction.

The officers of the association are: F. D. Coppock, president; Guy Baker, Greenville, executive secretary; W. E. Deville, Toledo, vice-president, and E. S. Warner, Akron, secretary-treasurer.

New Lime Burning and Hydration Plant

Numerous features stand out conspicuously at the new rotary kiln lime-burning and hydration plant of the Charles Warner Company at Cedar Hollow, Pa. The company seems to have adopted all the standard class of machines for various purposes that could be used advantageously on the premises.

The plant was laid out evidently with definiteness of plan. The whole operation presents original characteristics and elements that tend to increase efficiency and to give the best results the year around.

Crushing

The rock in the quarry is now handled by steam shovels, and it was largely to eliminate hand labor in the quarry that the rotary kilns were installed. The rock comes into the crusher house in 2-ton quarry dump cars, pulled up an incline in the usual way by a 4-ton hoist, driven by a 20-horsepower Westinghouse motor. The stone is dumped to a gyratory crusher, which reduces it to $2\frac{1}{2}$ inches and passes it to a 48-inch Symons disc crusher, from which it is taken by a

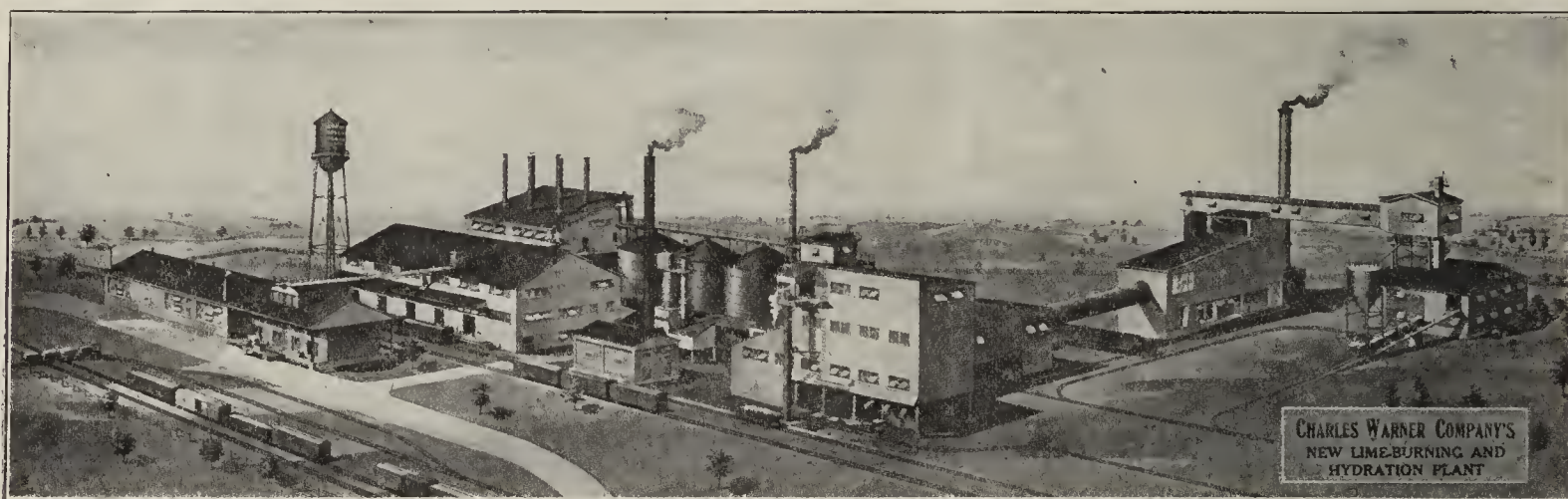
lime is distributed by an overhead conveyor to three steel storage tanks having a capacity of 6,000 tons, from which it is drawn when needed by screw conveyors for hydration.

The very large size of this storage is to provide a reserve for seasonal demands and to permit a large supply of ground lime to be accumulated during the months that the quarry can be operated.

Hydration

The hydrating is by the Carson system and involves six circular steel tanks of 200 tons each. The hydration process depends, according to Mr. Warner, on three vital principles. First, unusually fine grinding of the burned lime; second, thorough and very rapid mixture of the lime and water; third, long steaming in the hydrator tanks.

The exceptionally fine grinding previous to hydration is compensated by the fact that no cores or unburned material is rejected, all material going into the product. Tests indicate that the use of all the raw



A New, Modern Rotary Kiln Lime Plant.

vertical Beaumont elevator (manufactured by Beaumont Mfg. Co., 340 Arch street, Philadelphia, Pa.) to an Allis-Chalmers 48x12-foot rotary sizing screen, located at the top of the crusher house. The screenings from $\frac{3}{8}$ inch down are chuted to an outside bin, from which they are drawn by gravity to cars or trucks as required, and used largely for agricultural limestone.

The rest of the stone, ranging from $\frac{3}{8}$ inch to $1\frac{1}{4}$ inches in size, is separated, that above 1 inch being returned to the disc crusher, the rest making up the material for burning. The stone is carried forward by a drag conveyor, running in an overhead bridge to two hoppers, from which it is fed to the kiln. The excess stone is passed to a steel stone storage tank, from which it is removed by an underground drag conveyor, returned to the crusher house and re-elevated as needed. The capacity of the present unit is 100 tons every 24 hours, and space has been left for the installation of three more kiln units, as they may be needed.

The rotary kiln is 8x150 feet (manufactured by Vulcan Iron Works, Wilkes Barre, Pa.), fired by producer gas. The burned lime is discharged from the kiln to a rotary cooler, directly under it, from which it is discharged to a chain drag conveyor (manufactured by Link Belt Co.), which takes it to the quick-lime finishing department, where it is passed through two Williams pulverizers and elevated to a ground lime storage tank. From this tank it is drawn to a Smidth No. E16 tube mill, by which it is reduced to such fineness that 85 per cent passes a 100-mesh screen. The ground

material, when handled in this way, does not detract from the quality of the product.

When operating the hydrator the ground lime is drawn from storage and into one of three pug mills installed on top of the battery of hydrate tanks.

Here it is met by the proper amount of water and the mixture rapidly and thoroughly made. The resulting slurry is spouted to one of the hydrate tanks.

Handled in this way, each particle of quicklime is brought into intimate mixture with the water, and as it begins to slake is immediately covered with another layer of ground lime and water. This confines the steam so that every particle of lime is slaked in the presence of steam and under pressure. As each tank is filled it is covered and left to hydrate, preferably for about three days, the other tanks being filled successively. The capacity of the hydrating plant is 340 tons per 24-hour day. Under ordinary operation each 200-ton tank is filled in about five hours.

When the lime has remained in the hydrating tank for about the proper length of time, it is withdrawn by screw conveyors, elevated to a hopper, from which, passing an automatic scale, it enters one of the two tube mills and is ground in order to secure an entirely even product.

The Finishing Department

The finishing department has a capacity of 500 tons per 24 hours. This large capacity is for two reasons: First, to take care of large seasonal business; second, the product of kilns of older plants is finished and shipped from this building, being brought in on industrial tracks as required.

The products made by the company and prepared in the finishing building are hydrated lime, Alca lime, agricultural limestone and finishing white coat. The agricultural limestone is ground by two Fuller Lehigh pulverizer mills from screenings drawn from a storage tank in the crusher house. The finished materials are elevated to an overhead conveyor, which supplies hoppers above the six Urschel-Bates valve bagging machines in an adjoining building. The arrangement is such that three lines of cars are served, one from the finishing building, the other two from the bagging building.

Fuel and Power

Coal is brought in by rail, dumped into a track hopper and elevated three stories. It is burned in 10-foot rotary top gas producers, which supply the kiln fuel gas. This building also serves as a coal station for the company's vertical kilns, which are supplied by dump cars on the industrial track. The cars about the plant are moved by Jeffrey electric and Plymouth gasoline locomotives.

The plant is supplied with electric power through service lines at 13,000 volts. It is stepped down to 440 volts for distribution. About 500 horsepower is used for normal operations.

The buildings are wired with both open and conduit work, but steel taped underground cables are used from the substation to the different buildings.

Westinghouse type C. S. motors are used almost exclusively and ammeters are connected to nearly all motors—this for the purpose of letting the operator gauge the load and also to detect troubles, both mechanical and electrical.

Crushed and Pulverized Limestone Production in 1917

The output of crushed limestone in 1917 showed a decrease of 17 per cent (5,537,394 short tons) in quantity and less than 1 per cent (\$174,336) in value from that of 1916. The average price per ton was 66 cents, which was 11 cents more than in 1916. Of the total decrease nearly 72 per cent (3,972,352 short tons) was in crushed stone for roadmaking, a little over 1 per cent (56,274 short tons) in concrete, and about 27 per cent (1,508,768 short tons) in railroad ballast.

Crushed Limestone sold in the United States in 1916 and 1917, by Uses

	1916		1917	
	Quantity (short tons)	Value	Quantity (short tons)	Value
Road				
metal	13,245,634	\$7,416,984	9,273,282	\$6,420,257
Railroad				
ballast	8,088,673	3,650,647	6,579,905	3,394,495
Con-				
crete	10,849,729	6,647,803	10,793,455	7,726,346
	32,184,036	\$17,715,434	26,646,642	\$17,541,098

The only increase in 1917 is in the value of stone sold for concrete, which shows also the least decrease in quantity of production. Road metal showed the largest decrease in quantity (30 per cent) and in value (13 per cent). The decrease in 1917 followed decreases in 1916 of 9 per cent in both quantity and value.

The table below shows the output of crushed limestone in 1917 in the states that produced over 175,000 tons.

Crushed Limestone Produced in the United States in 1917

	Quantity (short tons)	Value
Florida	412,969	\$ 303,258

Illinois	4,468,439	2,468,330
Indiana	1,477,941	850,664
Iowa	551,012	390,137
Kansas	678,310	554,533
Kentucky	1,364,985	801,420
Maryland	175,297	197,814
Michigan	1,327,715	680,178
Minnesota	239,387	208,610
Missouri	1,036,979	907,059
Nebraska	382,241	391,351
New York	3,334,977	2,281,236
Ohio	4,140,007	2,381,432
Oklahoma	883,406	564,704
Pennsylvania	1,055,192	1,113,588
Tennessee	920,998	517,328
Texas	600,214	379,826
Virginia	1,345,965	911,294
West Virginia	560,741	319,016
Wisconsin	1,082,058	861,873
*Undistributed	607,809	457,447
	26,646,642	\$17,541,098

*Alabama, Arizona, Arkansas, California, Connecticut, Georgia, Louisiana, Montana, Nevada, New Jersey, New Mexico, North Carolina, South Dakota, Utah, Vermont.

Of these states 8 (Florida, Indiana, Iowa, Kentucky, Minnesota, Ohio, Tennessee, and West Virginia) decreased in both quantity and value; 5 (Kansas, Nebraska, Oklahoma, Texas, and Virginia) increased in both quantity and value, and 7 (Illinois, Maryland, Michigan, Missouri, New York, Pennsylvania, and Wisconsin) decreased in quantity but increased in value of output for 1917.

Over half the output of Illinois went into concrete and a little less than one-fourth into road metal; in Ohio one-fourth of the output was used for railroad ballast, a little less than one-third for concrete and nearly one-half for road metal; in New York two-fifths was used for concrete and a little less than two-fifths for road metal.

Though the condition of the iron trade during the first six months of 1917 indicated that a small decrease in the quantity of limestone marketed for use as furnace flux might be expected in 1917, the reports for the entire year show an increase, for the production was 25,574,146 long tons, valued at \$18,679,213, a gain of 1,950,638 long tons (8 per cent) in quantity and \$4,732,331 (34 per cent) in value over 1916. The average price was 73 cents per long ton, as compared with 59 cents in 1916. Full discussion of the flux industry in 1917 was published in Press Bulletin 377 of the United States Geological Survey.

Since the statistics of the production of pulverized limestone for use in agriculture were first compiled, in 1911, the output has steadily increased until 1917, when a slight decrease in quantity (0.3 per cent) was reported, although the value increased about 22 per cent. The output for 1917 was 1,040,248 short tons, valued at \$1,352,397. The burned lime used in agriculture in 1917 amounted to 488,297 short tons, equivalent to about 980,000 tons of limestone, and was valued at \$2,475,731—a decrease of 20 per cent in quantity and an increase of 11 per cent in value. The total quantity of limestone quarried in 1917 for use by farmers was therefore about 2,000,000 tons, as compared with 2,270,000 tons in 1916. The average value of pulverized limestone in 1917 was \$1.30, an increase of 24 cents. In addition to pulverized limestone and burned lime, 73,900 short tons of calcareous marl, valued at \$165,223, was sold for this use. (See United States Geological Survey Press Bulletin 378.)

**Pulverized Limestone Produced in the United States
in 1917**

State	Quantity (short tons)	Value
Georgia	32,537	\$ 58,348
Illinois	179,848	126,870
Indiana	46,100	39,403
Iowa	45,387	24,584
Kentucky	25,723	22,362
Michigan	62,027	58,147
New York	82,000	152,394
North Carolina	67,415	95,288
Ohio	66,341	93,133
Pennsylvania	138,323	261,396
Tennessee	60,237	87,738
Vermont	15,031	26,894
Virginia	40,580	46,489
Wisconsin	15,090	23,608
*Undistributed	163,609	235,743
	1,040,248	\$1,352,397

*Alabama, Arkansas, California, Connecticut, Florida, Kansas, Louisiana, Maryland, Massachusetts, Minnesota, Mississippi, Missouri, New Jersey, Oklahoma, Oregon, Rhode Island, Texas, Washington, and West Virginia.

Illinois was the leading state in quantity of output, but Pennsylvania, the next in rank, stood first in value. The output of Pennsylvania showed an increase and that of Illinois a decrease in both quantity and value. At many quarries pulverized limestone is a by-product, but at others it is the principal output. In some parts of the country, particularly in California, Kentucky, Virginia, and Wisconsin, where the farmers recognize the value of this product, they pulverize limestone on a community plan, which is promoted by state or county officials.

The quantity of limestone sold to sugar factories in 1917 showed a decided increase over that sold in 1916—from 369,028 short tons, valued at \$369,694, to 530,612 short tons, valued at \$666,138. The burned lime sold for this use increased from 21,923 short tons, valued at \$118,572, in 1916, to 47,546 short tons, valued at \$381,746, in 1917, making the total value of the limestone products sold for this purpose \$488,266 in 1916 and \$1,047,884 in 1917. Of the total quantity of the lime burned for use at sugar factories 70 per cent (33,614 tons) was produced in California. California also furnished the largest quantity of limestone for this purpose—124,070 short tons, valued at \$167,535, but was closely followed by Colorado, which produced 117,554 short tons, valued at \$144,125, and by Wyoming, which produced 96,288 short tons, valued at \$130,497.

The limestone sold to glassworks in 1917 amounted to 293,152 short tons, valued at \$344,479, an increase of 100,124 tons in quantity and \$163,157 in value. The burned lime sold for this purpose amounted to 60,624 tons, valued at \$316,280, making a total of \$405,103 for the value of limestone used in glass making. Pennsylvania, Ohio, and Missouri furnished about 70 per cent of the stone and Ohio over half of the lime.

The limestone used in making alkali amounted to 3,124,026 short tons, valued at \$1,417,898, an increase of 287,469 short tons, valued at \$451,636. There was also a considerable quantity of lime used for this purpose. This large increase was due to the increased manufacture of chemicals called for by the war. Michigan furnished 68 per cent of the stone for this pur-

pose, and large quantities were also quarried in New York, Virginia, and Kansas.

The stone sold to manufacturers of lime in 1917 amounted to 59,387 short tons, valued at \$31,736, a decrease of 54 per cent (71,342 tons) in quantity and 60 per cent (\$49,737) in value.

Of limestone sold for miscellaneous purposes in 1917 the most important products reported were 232,421 short tons of dolomite, valued at \$171,257, used for furnace lining and making patent refractory products; 39,498 short tons, valued at \$125,648, used as asphalt filler; 34,983 short tons, valued at \$75,326, manufactured for whitening and as a filler in paint, putty, soap, and rubber; 12,030 short tons, valued at \$8,818, used in the manufacture of mineral wool; and 73,214 short tons of dolomite, valued at \$89,189, used in the manufacture of basic magnesium carbonate. Other products reported either by individual producers or in quantities too small for segregation were stone sold for chicken grit, roofing gravel, stucco and terrazzo work, and filter stone, and stone sold to chemical works making powder, carbolic acid, calcium carbide, and other products.

Railroad Reconstruction and Expansion Calls for Concrete

A study of the distribution of expenditures approved by the Railroad Administration for 49 railroads having an aggregate mileage in excess of 150,000, shows that over \$64,000,000 is being spent for shop buildings, engine houses and similar betterments. This indicates that the railroad administration fully realizes the very great importance of keeping up and increasing, if possible, the efficiency of this great arm of transportation.

One of the most important structures on a railroad is the houndhouse—the “first aid” station for the prime motive power of the road. The work that is done in the engine house is of great importance in increasing the length of service of locomotives before they are put into the back shop for repairs, and the efficiency with which minor repairs such as are usually attended to in the roundhouse are made, greatly increases the average total of locomotives constantly in service.

Engine houses are particularly subject to fire hazard. Fires are kindled in locomotive fire boxes preparatory to raising steam while the locomotive is in the roundhouse. In times of great demand for motive power, roundhouse men are busily engaged and while much of the fire hazard can be reduced by installing proper lighting systems and convenient waste containers and restricting as far as practicable the use of torches, the fact remains that no class of railway buildings suffers so frequently from fire as do engine houses. Such fires are of a serious nature for reasons other than the loss occurring from the destruction of the building itself. The history of roundhouse fires indicates that in a great majority of cases, a considerable number of locomotives inside the engine house are “dead” and must be allowed to go through the fire as best they can. The result is much damage to the locomotive, requiring a considerable period of time and outlay of money before it can be put into service.

Terminal facilities, shop buildings, bridges and similar structures of the railroad will no doubt come in for considerable expansion, rebuilding or replacement in the railroad administration's plan for bringing the roads up to required operating standards.

Sand Company Making Tile

Batavia, N. Y., has a new industry in the drainage tile plant, No. 52 Swan Street, of the Batavia Sand Company of which George E. Priest of the Priest Realty Company is president and William A. Stetson of the Franklin Mills, secretary and treasurer.

Dunn Drain Tile machinery has been installed which enables the company to produce six completed tile every minute. The machinery was operated on December 27 for the first time and the company is well pleased with its successful operation which seems to be very simple and easy to operate.

450 Miles of Permanent Lincoln Highway Assured for 1919

The State of Illinois has approved of a \$60,000,000 bond issue, to construct a state-wide system of highways, embracing 4,800 miles, which assures the permanent construction of 120 miles of Lincoln Highway.

Pennsylvania voted to amend her constitution and opened the way for the construction of a \$50,000,000 system in that state, of which 330 miles of Lincoln Highway will receive attention.

In local communities, in other states, the same tendency toward removing the restrictions of mud roads has made itself felt.

There is in the November election a lesson to public officials generally and those having in hand the administration of highway affairs, and that lesson is that the people, under the strain of transportation deficiencies so clearly disclosed by war conditions, are in no humor to longer trifle with old types of road, and now that peace has come and the bars on highway construction are lifted the public has a right to assume that steps will immediately be taken to carry out its mandates for durable highways.

Durable roads and a greater mileage of connected, through highway systems mean more sales prospects for the maker and greater opportunities of profit to the user of cars and increased farm values to the farmer.

A new highway era is dawning in these United States.

Delivering Aggregate to Concrete Mixer

The scarcity and cost of labor has undoubtedly had much to do with the devising by contractors of new methods of saving labor in the handling of concrete materials. Several such methods have been described in CEMENT AND ENGINEERING NEWS. Another plan was worked out by Gibbons & Read, of Salt Lake City, in connection with concrete paving in Payson, Utah, which is described as follows:

Two inclines are stationed at the edge of the piles of pebbles and sand. By means of team and block and tackle a No. 3 skip scraper is used to draw the sand and pebbles directly off stock piles and up the incline, where the scraper is dumped into a horse-drawn cart that has been placed under the upper end of the incline. The bodies of the carts used are divided into two compartments, one holding 14 cubic feet of pebbles and the other 7 cubic feet of sand, struck measure. To prevent the aggregates from becoming combined when loading, a baffleboard or division plate is placed over the partition in the cart and removed when the latter is filled. Each cart, when thus loaded, contains the exact proportion of aggregate for one charge of the mixer.

When loaded the carts are backed directly into the hopper of the mixer and there dumped. The cement (4 sacks) is dumped on top of the aggregates in the usual manner.

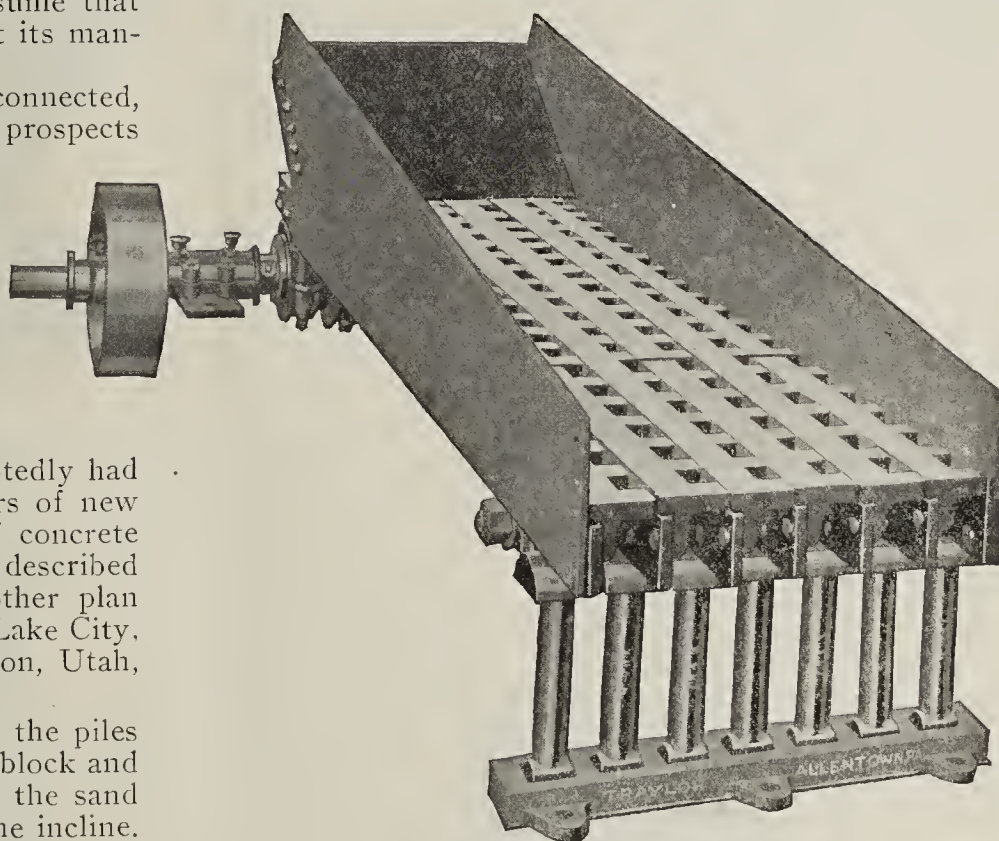
Three single horse-drawn carts are loaded by one scraper team, which loads both sand and pebbles. Not more than four minutes are required for a complete trip of one cart. By using three carts a loaded one is waiting at the mixer while the hopper is being loaded. This gives one and one-third minutes for each charge of the mixer.

Before making use of this method of handling aggregates to the mixer, the contractors tried it out on removing dirt from the subgrade during grading. As many as 70 wagon loads (each 2 cubic yards) have been loaded in an 8-hour day.

Sheridan Shaking Grizzly

A Simple Low Cost Screening and Feeding Device of Remarkable High Efficiency

By classifying the feed to your crusher you not only increase its capacity, but you cut down the power consumption as well. It is easily accomplished with the Sheridan Shaking Grizzly illustrated on this page. This grizzly automatically removes the fines from quarry feed containing lumps up to steam shovel size. Its capacity is ten tons per hour per square foot of screening surface when removing a 3-in. product. It is so sturdy that three-shift operation is the rule rather than the exception, write the manufacturers, The Traylor Engineering & Mfg. Co., Allentown, Pa., who have definite engineering data to submit on Sheridan efficiency and economy.



Sheridan Shaking Grizzly.

Concrete Shipyard

The gigantic concrete shipbuilding plant at Mobile, Ala., operated for the Emergency Fleet Corporation by the Fred T. Leyand Company will be a permanent fixture, according to General Manager R. C. Stadley. All concrete ships contracted for will be built and launched and will sail from this yard under their own steam.

Highway Construction

The action taken by the highway congress, in Chicago, which has just adjourned, after recommending the creation of a federal highway commission and urging extensive highway construction, is attracting deep interest in legislative circles at the national capital.

In the first place much significance is attached to the fact that this was the first real congress devoted to highway development ever held in the United States. The enthusiasm shown and results obtained is taken to mean that the people of the country are now ready for a nation-wide road building campaign.

The fact that the highway congress was composed not only of the industries, but because state highway officials joined in with the other interests, but also a very large representation of Chambers of Commerce and other civic organizations from all parts of the United States, is being commented upon here as adding emphasis to the fact that the time is at hand for real road-building.

Fourth Assistant Postmaster General Blakslee, who loses no opportunity to urge a greater use of the highway for parcels post motor routes, is back in Washington, highly elated over the aroused interests in modern road construction. He foresees a rapid extension of that service as fast as permanent roads can be constructed, and from his experience so far in the operation of parcel post routes he is more firmly convinced than ever that the key to reduced living lies in the road. Others in official and legislative circles are also beginning to see, judging from public comment as a result of the deliberation of the first highway congress, that no amount of marketing legislation will equal the paved road as a means of effecting economies to the advantage of the producer and consumer.

To put the matter briefly, the first highway congress, attended as it was by representatives from every state in the Union, is looked upon as the turning point in highway construction, equipment and operation, from a wasteful to a dividend earning basis.

The Dunn Concrete Machines

The W. E. Dunn Manufacturing Co., 414 24th Street, Holland, Mich., have just issued a 64-page book containing a great deal of valuable information for con-

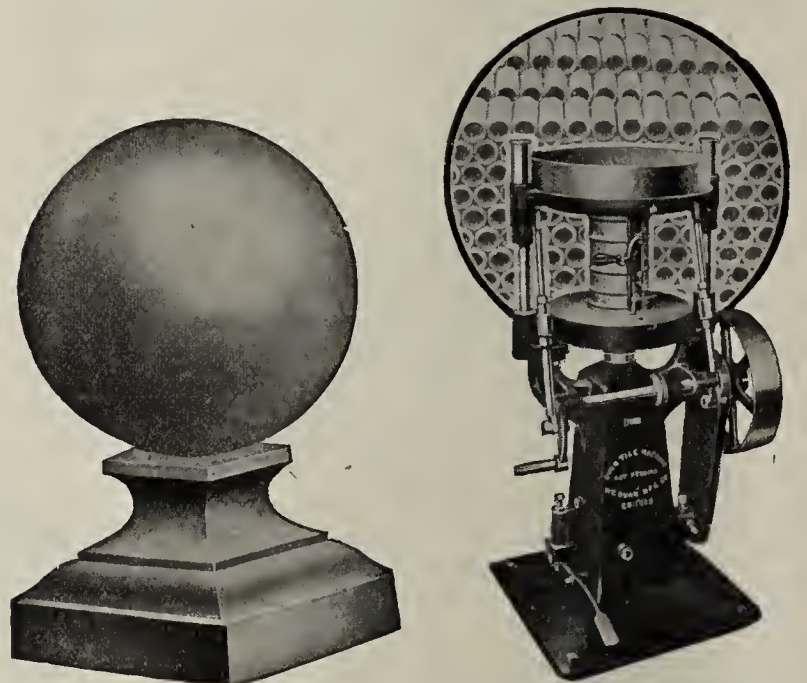
tractors interested in the manufacture of concrete products.

This book gives the cost of manufacturing sewer pipe and tile, cement building blocks, chimney blocks, porch blocks, cement brick, ornamental fences, vases,



Dunn Block Machine.

flower boxes, well curbs, cement lattices, caps, sills and steps, etc. It gives complete information about the machinery and molds necessary for manufacturing the above products and will prove valuable to contractors

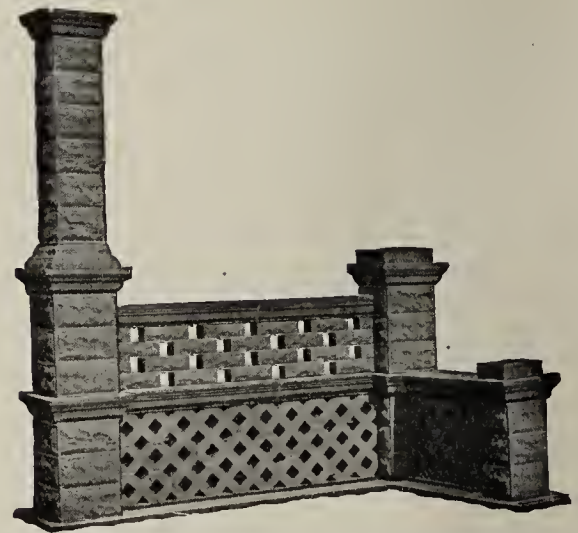


Dunn Cement Tile Machine.

who contemplate manufacturing cement products or wish to extend their line. This company manufactures a complete line of cement machinery and molds and will be glad to mail their book to every interested builder or contractor.



Dunn Sewer Pipe Mold.



Dunn Ornamental Concrete Molds.

Material Needed for Million Homes

Can America Meet the Reconstruction Demands of Europe?

Belgium, England and France are about to call upon the United States to supply building material and equipment for at least 1,000,000 houses, according to a statement by William C. Redfield, of the Department of Commerce, which says:

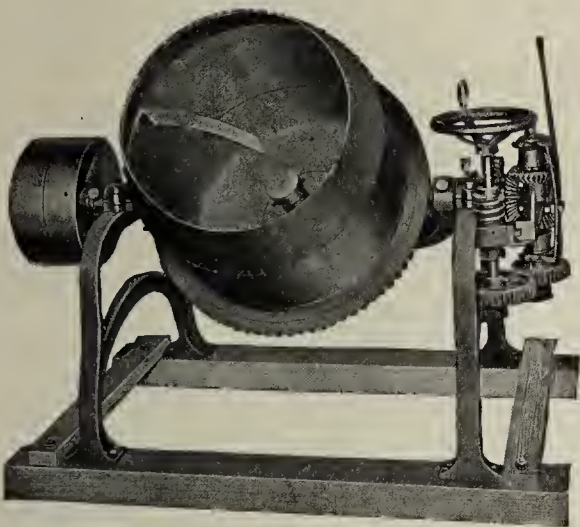
"This fact, coupled with disclosures made to various trade and commerce conventions that have been held recently, including the important conference of the Portland Cement Association recently held at the Biltmore Hotel, New York City, with reference to the domestic building situation, has brought the American building investor face to face with a condition the solution of which appears to be possible chiefly by immediate action.

"The problem centers chiefly in the question of building material demand and the capacity of American manufacturers to meet an unprecedented domestic call for construction material and also to take care of the imperative requirements of other parts of the world besides."

Huge Programme

"In discussing the situation, Secretary William C. Redfield, of the Department of Commerce, said: 'Great Britain is short in construction some 500,000 houses. Belgium and France together are in immediate need of some 500,000 more, so that one million new houses will have to be presently built, taking large quantities of lumber, cement and hardware from the United States.'

"D. R. McLennan, retiring chief of the Non-War Construction Section of the War Industries Board, has also emphasized that the exportation of building materials may positively be set down as an assured eventuality.



Dunn Concrete Mixer.

"Chairman Edwin R. Hurley, chairman of the United States Shipping Board, upon the eve of his departure for Europe, authorized the statement that just so fast as the merchant ships come off the ways they will carry American building materials to Europe.

"A computation of the probable amount of new building construction through the issuance of private capital for the United States is being made at present. It is already evident from figures at hand to show that there is approximately twice as much building construction in project in this country today than in the best previous year ever recorded. No consideration is here given to the building demands of South America and Canada where, especially in the former, American cement is already supplementing the German

brands that formerly were almost exclusively used there.

The Investors' Alternative

"The building investor is face to face with an alternative of either taking what material he can get in the already short supply at existing prices or deferring his operation until prices come down. If he proceeds under present conditions he will have high prices, but a demand for the finished building. If he waits he may find prices lower in the fullness of time, but necessary building construction will have gone ahead and his demand will not be there.

"Foreign building material demand, as far as Europe is concerned, probably will be temporary, but that of South America will be of a permanent character.

"The demand for construction material in the United States cannot be met, even with present plans in project, short of two years, based solely upon normal demands of commerce suddenly expanded from domestic to world-wide proportions. The estimate does not include speculative construction of any kind.

Prices Under Control

"The price situation as it pertains to domestic materials is developing of its own volition without regard to organized control, so far as can be discovered by a rigid investigation into the price markets and the causes of present price movements.

"The mason material dealers are taking the almost unprecedented attitude of counselling against anything like arbitrary price advances. In fact a federal department is watching carefully for any evidence of price movements upward that have no foundation in necessity. For that reason while no fixed government quotation has been made in certain important basic building commodities, the government is holding a potential control over any commodity that shows signs of stampeding.

"The government looks to the building and allied industries to absorb each of the returning soldier and naval labor and the intimation is plainly made in some channels that it intends to see that its plans are not upset by any price manipulation that will frighten off the prospective building investor.

Advises Caution

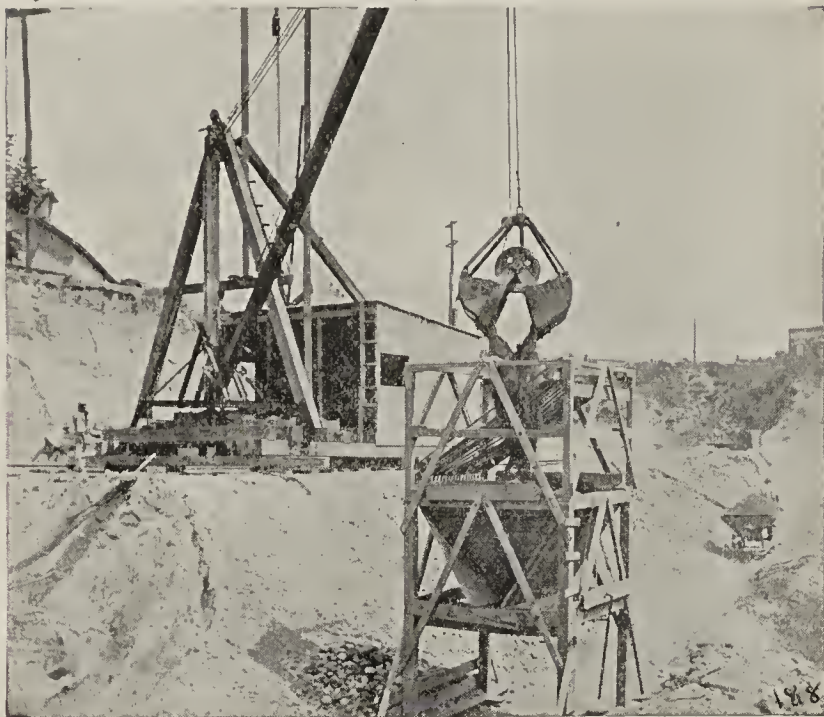
"Those with prospective building operations will find such to their advantage if they will consider fundamentals in determining to defer construction work. It took ten years for building material prices to find their normal level, with only a few exceptions, following the Civil War, and the construction programme of the country then was only sectional, whereas today it is world-wide and far beyond the capacity of present American building material manufacturers to supply.

"Manufacturers who think to rush into the market with a cut price plan will have little or no interference from others who probably will let them load up with orders they must fill below cost, while others who sit back will reap the benefits of riding with the demand and not by trying to force it, on the basis that without any artificial effort there will be plenty of business for every one when the proper time comes; judging from inquiry and activity in architects' offices, the first flush of activity is here.

"Prices of practically every building commodity are remarkably steady. A new plan is being worked out to stabilize the market for the benefit of those contemplating construction which will become operative on January 1 for New York and vicinity, as an earnest of the desire of the distributors to meet the builders upon a more neutral basis."

Haiss Excavating Buckets

A clamshell bucket manufactured by the George Haiss Mfg. Co., Inc., New York, N. Y., suspended from the boom of a wooden traveling derrick, was installed by E. Bennett in a sand pit in Brooklyn, where it

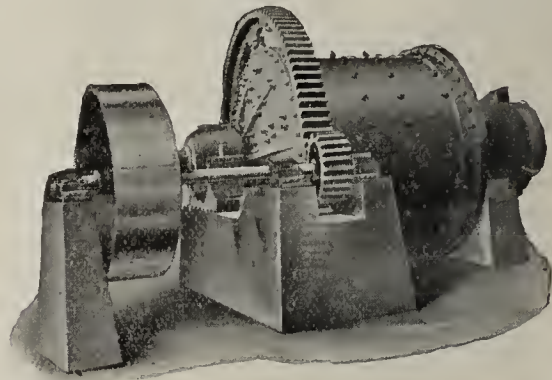


Clamshell Bucket Discharging Sand and Gravel on Screen Over Loading Hopper.

excavated a large quantity of sand, much of it under water, and discharged it over an inclined screen mounted above a loading hopper in a movable tower. Large stones were rejected and the sand and gravel was afterwards delivered from the hopper to industrial cars hauled out of the pit by a cable operated by a hoisting engine.

Traylor Ball Mills

The illustration shown herewith is a Traylor Ball Mill used by many of the leading limestone producers for pulverizing agricultural lime. The manufacturers, Traylor Engineering & Manufacturing Company, Allentown, Pa., declare it is the simplest and most efficient pulverizing machine made. They run at slow speed, are dustless and require no screens and the min-



imum attention. They consume the minimum amount of power per ton of rock crushed and will pulverize crusher rejections as readily as they will screenings. They're made with capacities of from two tons per hour up. The Traylor ball mill is the most extensively used machine for crushing to through 30-in. mesh by cement mills.

Highway Development Department, Garford Motor Truck Co.

The Garford Motor Truck Company, Lima, Ohio, announces the selection of Mr. J. F. Bowman of Detroit as sales manager succeeding Mr. S. M. Williams



Winter

Doesn't Stop the Burial Vault Business

There is a constant demand the year round. A demand that you can supply with just one set of our Steel Molds. Think how nice it would be to have a neat little income during the winter months and all the year round.

The AUTOMATIC SEALING VAULT

pay big profits from fifteen to 24 dollars on each one. You can develop this as a side line or devote all your time to it. Make the dollars come in this winter

by making the AUTOMATIC SEALING VAULT

The First Step is to send for information. We'll furnish full details and particulars. Write Today.

The Automatic Sealing Vault Co.

216 East River Street

Peru, Ind.

The
Fin-
ished
Vault



FOR SALE:

Crushed Stone plant near Blue Springs and Wymore, Nebr., on Union Pacific and C. B. & Q. railroads. The quarry farthest west in Nebraska or Kansas. Forty feet of stone. Light stripping. Large territory. Good prospects. Sixty-seven feet of shale under quarry bed. Ideal location for Portland cement or fancy brick plant.

G. H. DAVIS

Blue Springs,

Nebr.

who takes charge of the new Garford department known as the highway development department.

Mr. Bowman is well known in the motor truck industry, and though a young man, comes to the Garford company with many years of work in the motor truck field, having advanced through the various departments to that of sales, for which he is particularly well fitted. Mr. Bowman represents the progressive element and has a wide and successful experience in organization and sales work.

Mr. Bowman has more recently been identified with the Federal Motor Truck Company where he acted as director of sales for several years, and during the last period of the war was interested in United States government contract work in connection with the production of Liberty Trucks in Detroit.

The acquisition of Mr. Bowman to the Garford organization is only in keeping with its progressive policy.

News Items

On every hand are evidences of more serious attention to the matter of the quality of the sand, gravel and crushed stone which are to be used in concrete.

Eye injuries sustained in the quarry are generally caused by flying bits of rock. Where workers are breaking stone by hand, if other workmen are near they should be protected by screens which will prevent the flying of small particles. The employees breaking rock should, themselves, wear goggles. These accidents are of importance, as will be appreciated from the fact that in the last three years in the quarries of cement plants 3,752 days have been lost on account of them. This figure is equivalent to more than ten years lost.

Edward R. Root, aged 66 years, secretary and treasurer of the Wolverine Portland Cement Company, Coldwater, Mich., died on October 3rd.

Beaumont Manufacturing Company, 460 Chestnut St., Philadelphia, Pa., are mailing their new catalog 37, giving descriptions, illustrations and dimensions of Standard Beaumont gates for controlling the flow of granular material from bunker. The design of ash pits under boilers and the correct gate to use for this purpose are illustrated. This is an interesting booklet and will be mailed free of charge to our readers.

New Bulletin

Amsco Manganese Steel Sand and Gravel Pumps

The American Manganese Steel Company of Chicago is distributing a very interesting bulletin concerning their Amsco manganese steel sand and gravel pumps. This bulletin, of 26 pages, illustrates and enumerates the advantages of the Amsco pumps. The demand for a pump that will stand up under the severest tests and that will save delays and reduce operating costs is rapidly increasing. "It's not the first cost; it's the upkeep!" Sand and gravel pumps constructed of cast iron or carbon steel are usually found to be inadequate for severe service, the American Company write. The Amsco centrifugal pump has been carefully designed to meet all the requirements of a sand and gravel pump and it is made of manganese steel in all wearing parts.

Write
for
this
Catalog



BEAUMONT MFG. CO.

340 Arch St., Philadelphia

New York

Boston

Chicago

WANTED

15 side dump quarry cars,
standard gauge, four or six
yard, with all-steel under-
frame. Address

**Greenville Stone &
Gravel Company**

1628-29 Exchange Bldg.

MEMPHIS, TENN.



**These Gears Look Alike.
Can you tell the difference?**

You could see the difference pretty quickly if you had both at work on a machine
One of them is made of

STROH STEEL PROCESS

The other is—just steel. The difference is in the way they wear. The work they do.
“Stroh” Gears and Pinions will so far outwear those made of any other material that comparative statements are almost incredible. And breakage in “Stroh” Process steel is unknown.

HERE IS A WAY TO SAVE MONEY

Write us and tell us what machinery you want Gears and Pinions for and we will prove to you that “Stroh” Gears and Pinions will save you money. Write us now while you think of it.

Stroh Steel Hardening Process Co.
PITTSBURGH

PULVERIZED AGRICULTURAL LIMESTONE

made and prepared in the new Cedar Hollow, Pa., plant of the Charles Warner Co., illustrated below, is produced by two

FULLER-LEHIGH PULVERIZER MILLS



The Fuller-Lehigh Pulverizer Mill is a Complete Self-Contained Grinding Unit and is the Most Economical Mill for Producing Agricultural Limestone, Cement, Ground Phosphate Rock, Powdered Coal, etc. Reduces lump material to 20, 40, 60, 80, 100 or 200 mesh without requiring any outside accessory equipment.

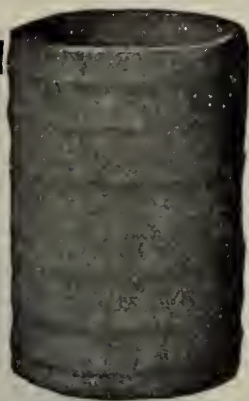
Descriptive Catalogue Upon Request

FULLER-LEHIGH COMPANY

NEW YORK, 50 Church St.

- Fullerton, Pa., U. S. A.

CHICAGO, McCormick Bldg.



Drain Tile Sales Will be Larger Than Ever

The farmer is urged to still greater crop production; not a square foot of land can be left uncultivated. A huge amount of drainage will mark next year's activities; drain tile will be at a premium.

Every concrete products plant should get in shape to handle the biggest spring business in drain tile ever known. Almost every plant is capable of making tile at very little additional outlay. We post you on manufacturing and furnish all equipment.

Dunn—the Standard Machine

Ninety per cent of high grade tile is made on the Dunn machine, because it absolutely guarantees a strong, lasting and superior product. Double packing and double troweling are features only of tile that are Dunn-made. Easily better than clay tile, and can be sold in competition with it.

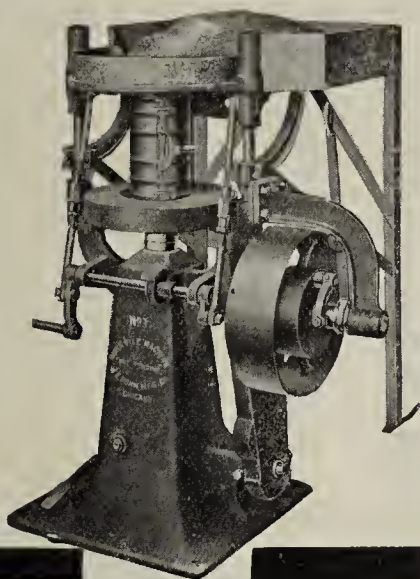
The Dunn machine makes manufacturing easy and highly profitable, and is sold at a lower price than any other machine of its capacity. Write for bulletins on the machine and the business.

W. E. Dunn Mfg. Co.

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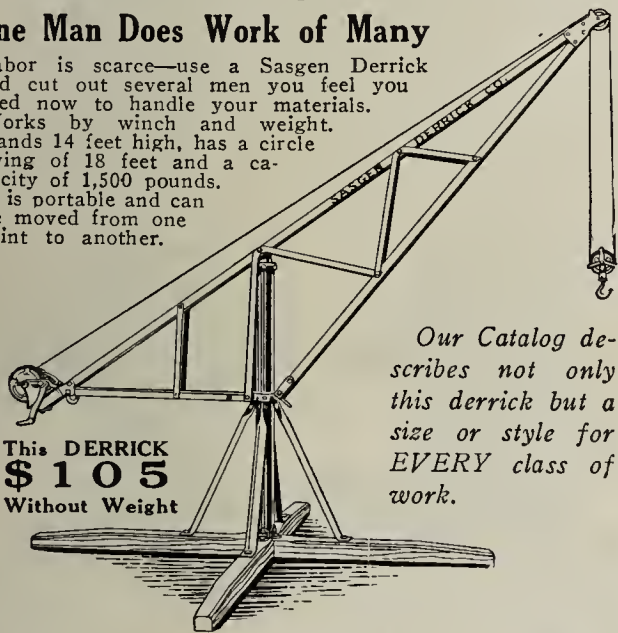


Load and Unload With a Sasgen Portable Derrick

The Sasgen Circle Swing Counterweight Derrick cuts costs, labor and time loading or unloading material from cars or wagons.

One Man Does Work of Many

Labor is scarce—use a Sasgen Derrick and cut out several men you feel you need now to handle your materials. Works by winch and weight. Stands 14 feet high, has a circle swing of 18 feet and a capacity of 1,500 pounds. It is portable and can be moved from one point to another.



This DERRICK
\$105
Without Weight

Our Catalog describes not only this derrick but a size or style for EVERY class of work.

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Moderate in Price and with a Reputation for doing more than is claimed for them

Jaeger Mixers make good because they are made good. No useless parts—no skimping. They are big enough for the big jobs and not too big to handle the little ones with profit.

And there's a Jaeger Mixer that just fits your needs. Let us tell you about it.

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Pavers,
Grouters,
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Pumps,



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Mixers,
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Contractors' Equipment BUILT OF STEEL WITH HYATT ROLLER BEARINGS

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OUR
HIGH DRUM
TWO BAG
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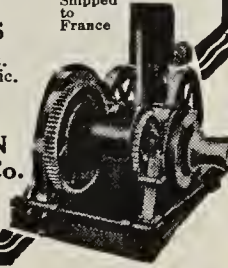
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Cement Machine Co.
Inc.
Keokuk, Iowa



CALDWELL'S HELICOID

HELICOID Screw Conveyor is heavier, stronger and better made than any other. Requires fewer repairs—no lapped and riveted joints to come apart—flight all one piece. Special hangers, bearings and boxes for cement work. If you have anything to do with the manufacture of cement, you should write for our Catalogue.

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Recognized as standard; used and recommended by leading engineers, road builders and cement workers everywhere. Valuable information about concrete tile and culverts, crushing strains and stresses can be obtained free by asking for Bulletin 29.

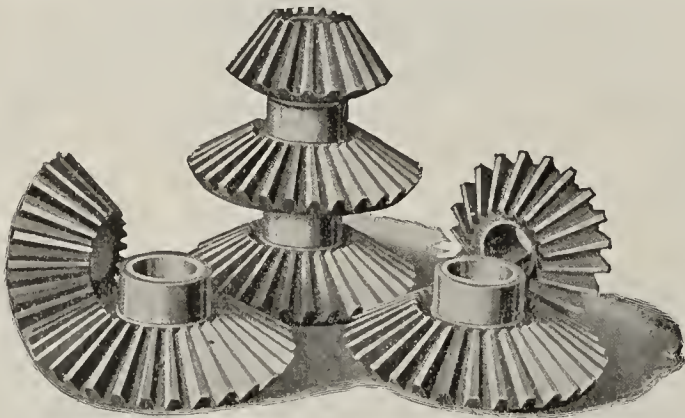
NORTHWESTERN STEEL & IRON WORKS
(Capital \$200,000) EAU CLAIRE, WISCONSIN



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Get ready now for a profitable contracting season by thoroly investigating the POLK SYSTEM of building monolithic grain bins, water towers, coal pockets, and silos. For the concrete contractor 1919 offers the brightest outlook in years. Write today for information on POLK SYSTEM building.

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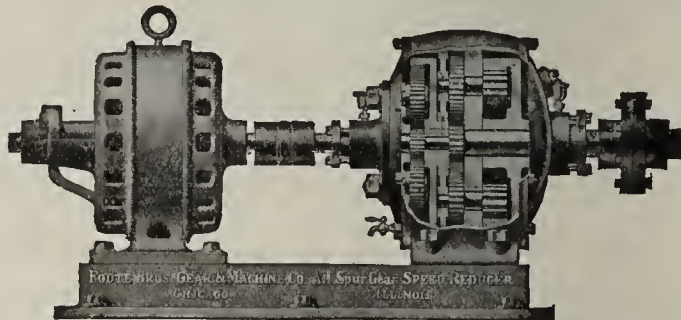
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We can meet your Reinforcing Steel Requirements. This means not only quick shipment from the mills but co-operative service for rapid transportation. If you want to know just what your exact cost will be, send us the Blue Prints and we will give you a lump sum bid on all the steel sheared to lengths, bent to specifications and delivered to the job.

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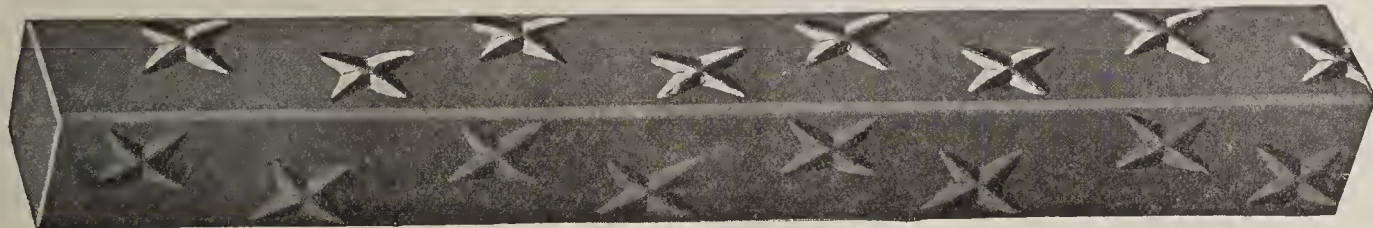
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In Open Hearth Steel (New Billet Stock), Hard Grade, and Rail Carbon Steel (Rerolled).

The mechanical bond is theoretically correct and is guaranteed by us, having been designed by expert concrete engineers and approved generally by engineers and architects.

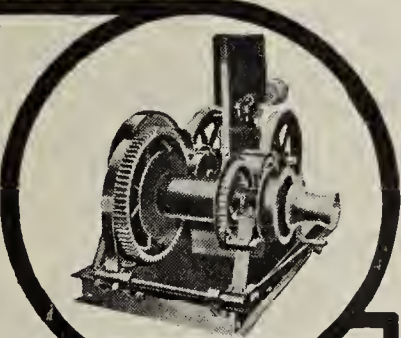
The corners are rounded to prevent splitting of the concrete. Bending, fabricating and setting are easily done with these bars. Sizes $\frac{3}{8}$ to $1\frac{1}{4}$ inch. Lengths up to 85 feet.

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with the smooth inside surface, having already furnished large quantities for Potash Recovery plants, we are able to give especially careful attention to the construction of this class of Pipe.

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American Ring Pulverizer LIME-STONE FOR THE FARMER

Make money out of your waste pile. One ton of limestone dust sells for \$1.50 to \$2.00 f. o. b. plant. Cost of production 15 to 30 cents per ton. The patented American

Ring Pulverizer is doing it. Our friends made thousands of dollars out of material that had to be dumped before—to the benefit of the farmer and Uncle Sam.

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We crush everything.
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STEEL BARS

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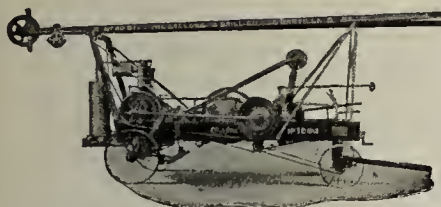
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PURIFICATION SYSTEMS
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A Big Blast-Hole Drill That's Reliable



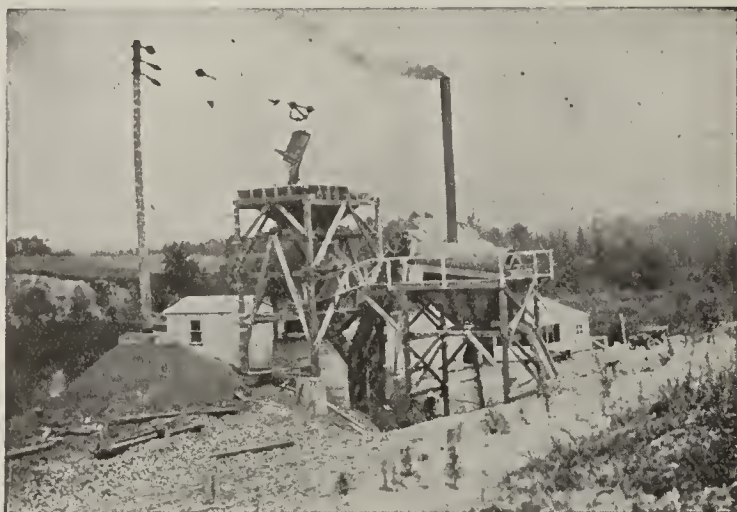
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No. 14**

Heavy, solidly braced frame—Sill timbers 4" x 14". All machinery placed directly on the main sills protecting it against strains and preventing top heaviness. **Eighty per cent (80%) of the castings are cast steel—not cast iron.** The Cyclone No. 14 is the only Blast-Hole drill so built. Furnished in Steam, Gasoline, Compressed Air or Electric Power; traction or non-traction.

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PULVERIZED COAL EQUIPMENT

AERO PULVERIZER CO., 120 BROADWAY, N.Y.

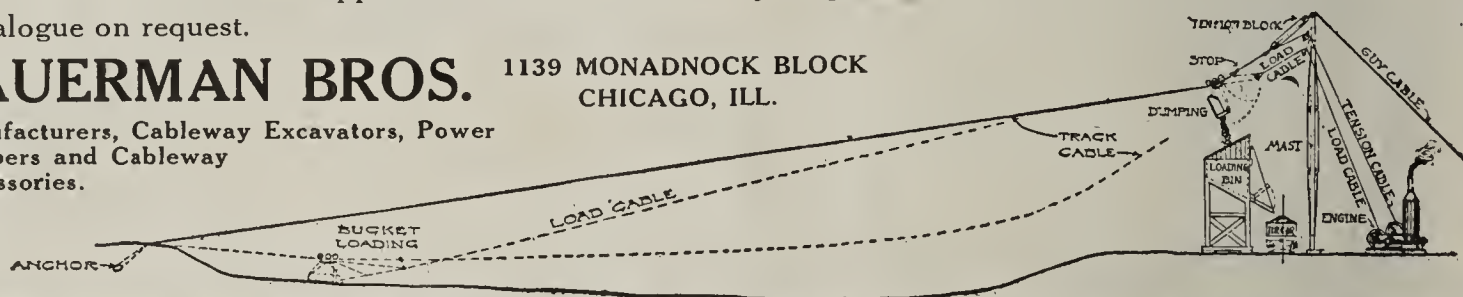


The Sauerma Dragline Cableway Excavator is digger, conveyor and elevator combined in one. It is the direct method from pit to plant. It digs, conveys, elevates and dumps in one continuous forward operation. Operated by a double drum friction hoist under one man control. One Machine—One Operation—One Man Control. If you are interested in the application of this machine to your plant write us for further information. Catalogue on request.

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1139 MONADNOCK BLOCK
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Manufacturers, Cableway Excavators, Power
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Accessories.



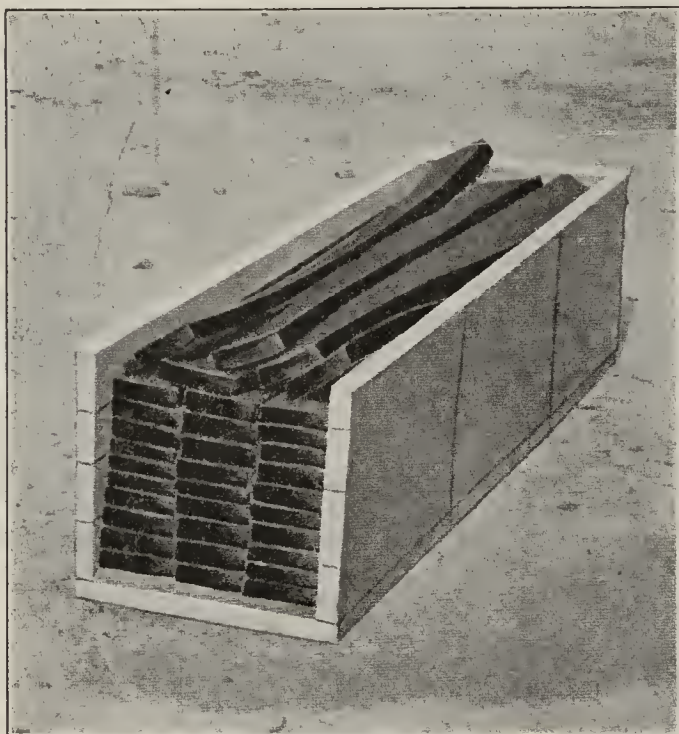
WOULD YOU USE AN INTERMEDIATE SYSTEM FOR CONVEYING YOUR FINISHED GRAVEL FROM PLANT TO CAR IF YOU COULD SPOT THE CAR UNDER THE SPOUTS OF THE BIN?

Not If You Could Help It Would You?

Then is it not just as logical to do away with an intermediate conveying system between pit and plant?

Are you using one machine for digging the material and another to convey it to the plant when you could just as well use one machine for the combined operation, saving the additional labor, machinery and upkeep cost?

Genasco Expansion Joints



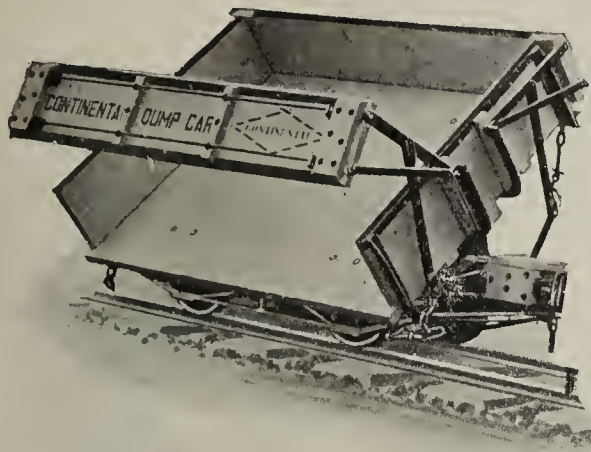
have all the advantages of other prepared joints for concrete, wood-block, brick and granite-block pavements—economy, ease of installation, the avoiding of melting and pouring—and besides this

Are All Asphalt

The entire thickness of a Genasco joint serves the purposes of expansion and contraction. Ready-made joints that contain felt or some other form of re-enforcement cannot do the work of the Genasco all-asphalt joint. Any thickness or depth.

The best way to judge this joint is to see it. A life-sized sample will be sent to any one interested. Write for it today.

THE BARBER ASPHALT PAVING COMPANY
Philadelphia, Penna.



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Built Better Than Ever

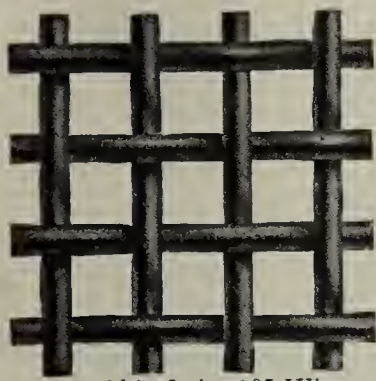
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We build all sizes and types of industrial cars for any specific requirements.
Write us concerning your needs.

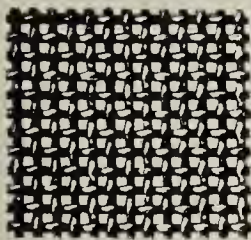
Continental Car Co. of America, Inc.

General Sales Office and Works, Louisville, Ky.

Cleveland Double-Crimped WIRE CLOTH



2½ Mesh; .105 Wire



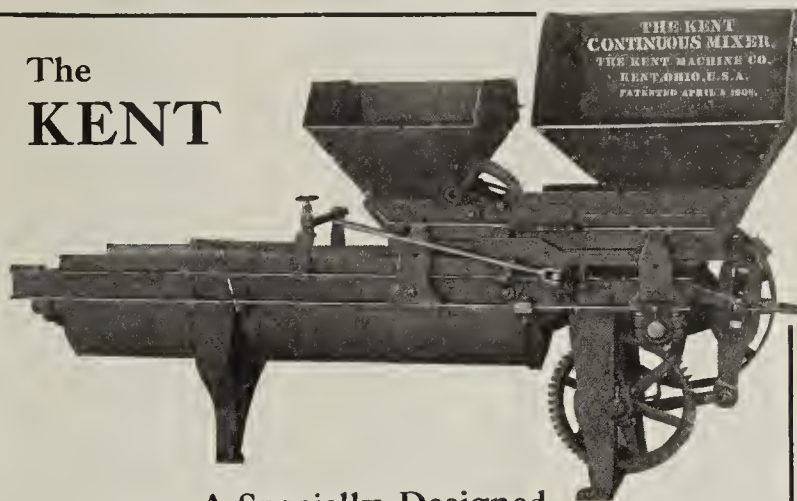
12 Mesh; .047 Wire

Renowned for its Uniformity, its Superior weave, its Durability. Especially adapted for SAND, GRAVEL and CEMENT Screens. A large stock of the various meshes always on hand.

Price Right—Catalog on Request

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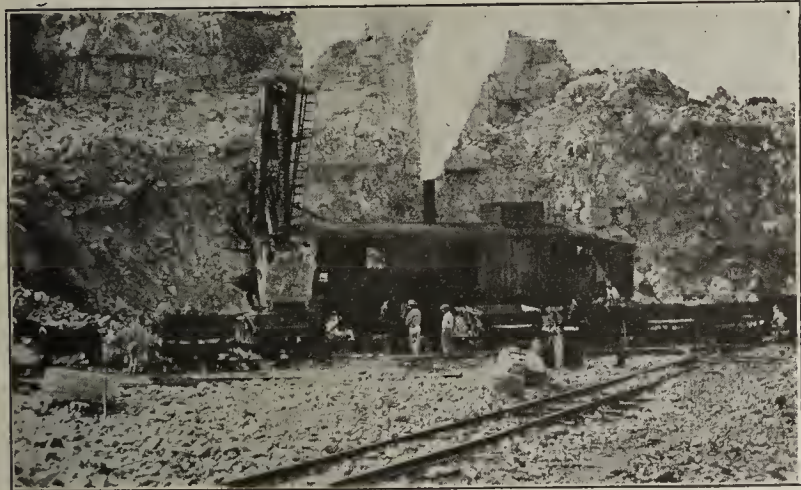
A Specially Designed Mixer for Products Plants

Seventy per cent of the bigger block, tile, brick and specialty concrete products plants of the country use the famous Kent Mixer.

Equipped with automatic feeding device, it makes certain a proper proportioning of aggregates and being continuous in operation, it saves time and labor. The biggest concrete products plant in the world has found that four Kent machines will mix fast enough to keep its many tampers and mold machines busy.

Write today for descriptive literature and prices.

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Kent, Ohio



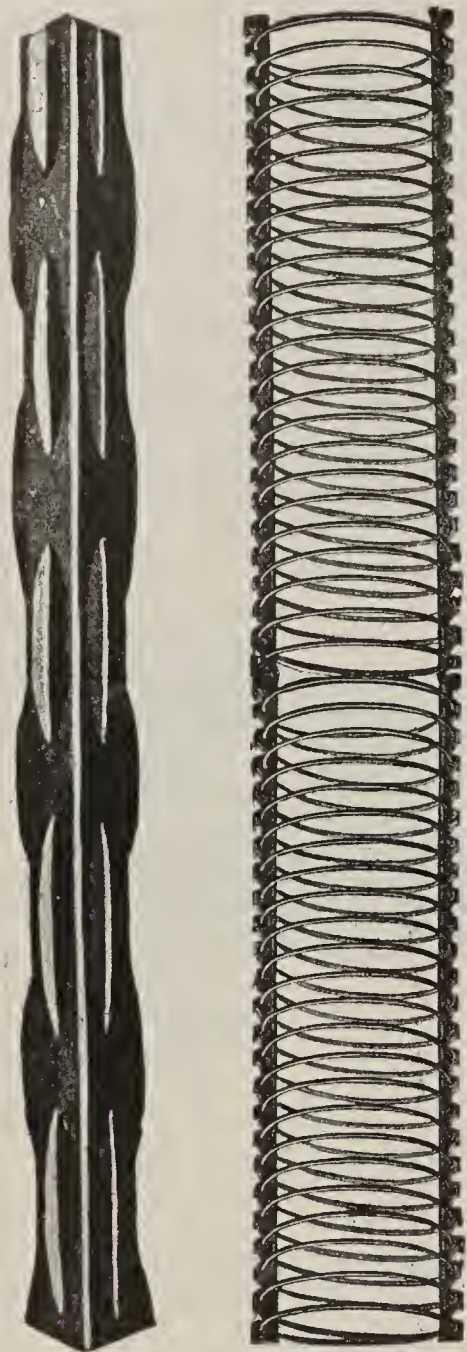
Western Dump Cars for Stone Quarries

**We Build Them Strong. They Are
Made of the Very Best Material**

This interesting picture taken in an Arkansas stone quarry. One mule draws a 2-car train to the crusher. One of many industrial uses for Western Dump Cars. They are used for hauling all kinds of material in all parts of the world.

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Western Wheeled Scraper Co.
AURORA, ILL.



STEEL BARS

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FOR

REINFORCED
CONCRETE
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“Bars on the Job Ready for Your Men”

Delay, caused by the failure to have your reinforcing material on the job not only throws out your calculations but also the schedule of every other contractor on the job.

You can save the loss of much time and money by specifying Havemeyer Bars for your reinforced concrete work.

Their prompt service insures your having bars on the ground when the men go to work.

HAVEMEYER BAR

Service insures direct shipments of reinforcing steel from our Chicago warehouse, which is located within easy teaming distance of the loop and makes delivery when material is needed.

Havemeyer Products, Bar-Tys, Bar-Spacers, Ty-Chairs, Beam-Saddles, Etc., keep the steel in its right place while the concrete is being poured.

Try Our Service

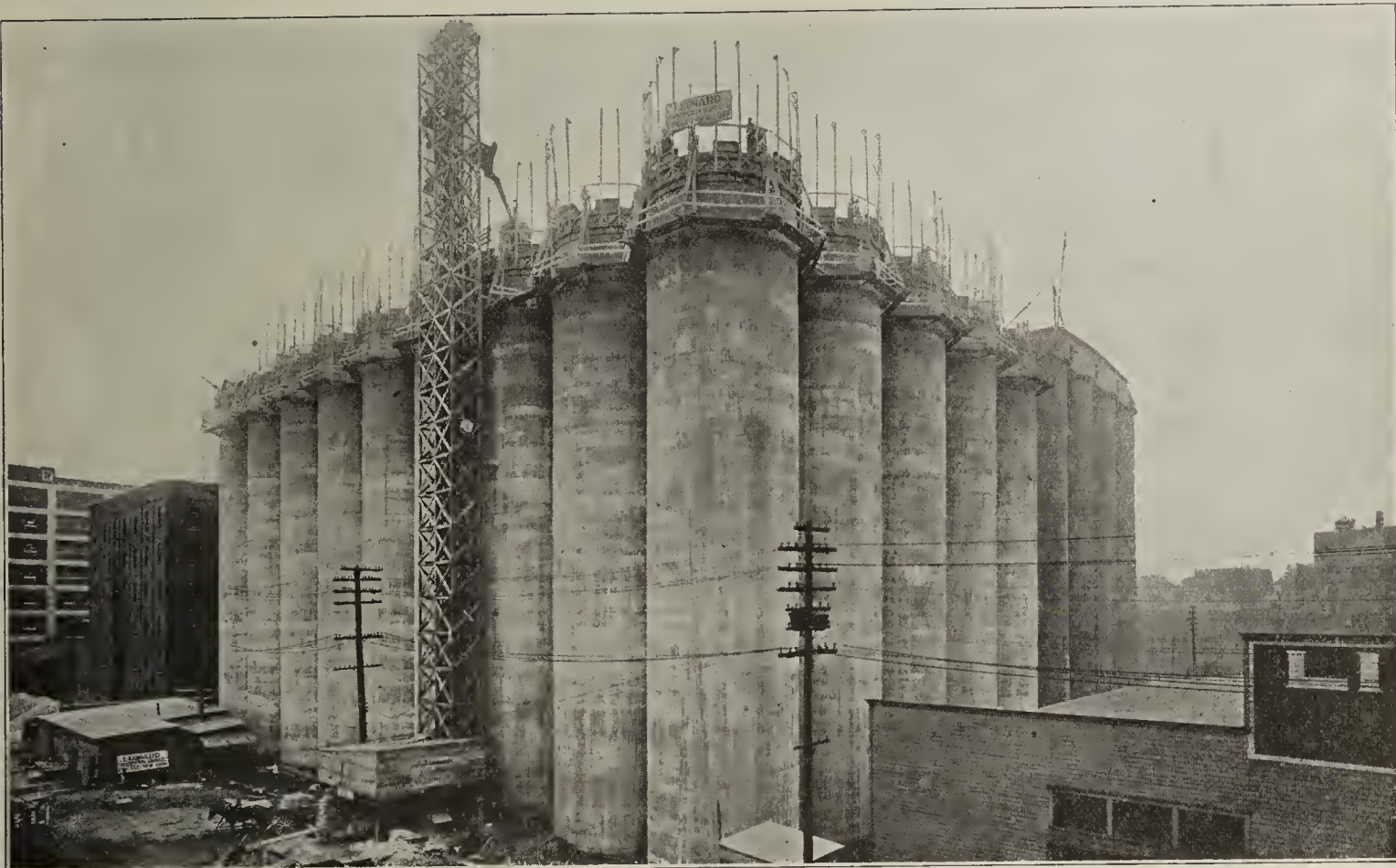
CONCRETE STEEL CO.

MONADNOCK BLDG.

CHICAGO

INVESTIGATION AND EXPERIENCE ARE PROVING THE RELIABILITY OF HYDRATED LIME

FOR WATER PROOFING AND TO FACILITATE POURING CONCRETE



In these 51 concrete storage tanks, recently erected in Cedar Rapids, Iowa, by the Quaker Oats Co., there are approximately 12,500 cubic yards of concrete—1-2-4 mix. The walls are perfect cylinders, with no lips or bulged surfaces.

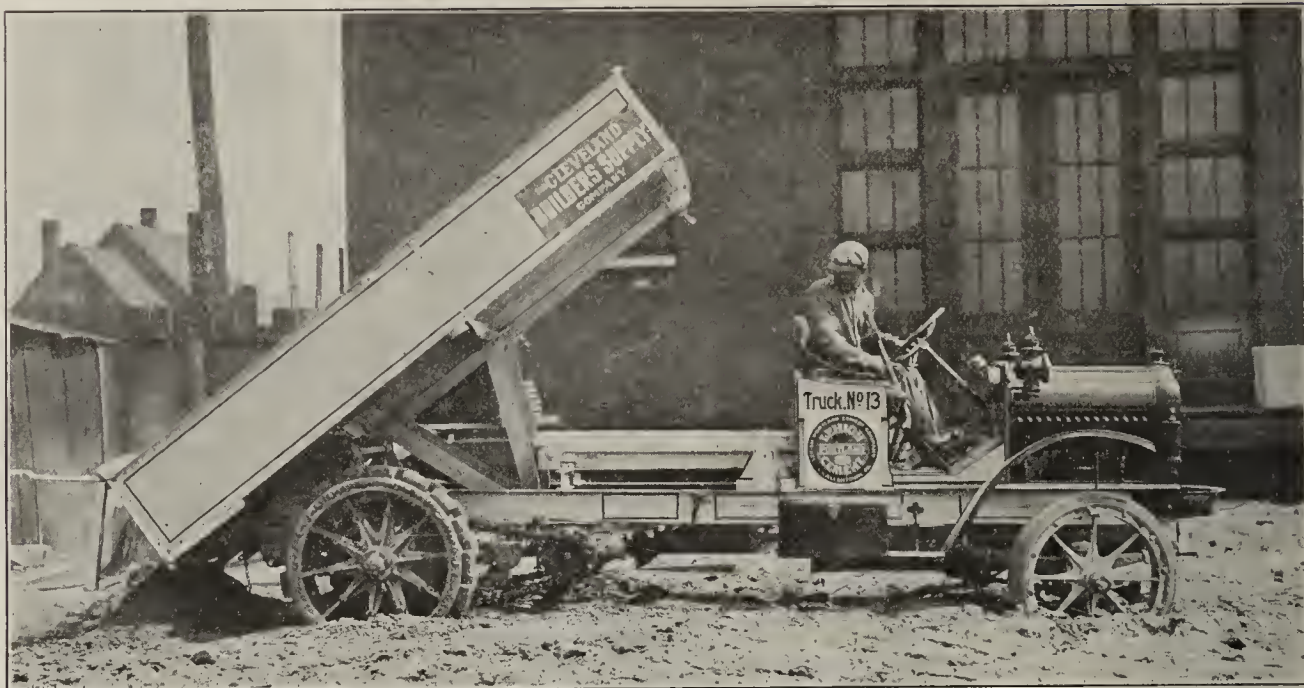
Hydrated lime was used for waterproofing and also to facilitate pouring the concrete and lifting the forms, owing to its lubricating properties. In mixing, 25 pounds of hydrated lime was put into each batch, which made the percentage of lime to cement a little over 8% by weight. The mixers used were of such size that three bags of cement could be used in each batch.

Considerable credit is given by the Leonard Construction Co. of Chicago to the lime. The statement is made that the lime gave the exterior surface a white and uniform appearance, and that the surface needed no subsequent coating. There were no joints where the concrete stuck to the forms and "lifted," as it does in many cases where the concrete is not of uniform mixture.

Write any of the following competing manufacturers of Hydrated Lime for complete information about Hydrated Lime in Concrete

Marblehead Lime Co., Chicago—Kansas City	Ste Genevieve Lime Co., St. Louis, Mo.	O. C. Barber Allied Industries Co., Canton, Ohio	John D. Owens & Son Co., Owens, Ohio.
Port Byron Lime Assn., Port Byron, Ill.	Palmer Lime & Cement Co., 103 Park Ave., New York, N. Y.	Kelley Island Lime & Transport Co., Cleveland, Ohio	Woodville Lime Products Co., Toledo, Ohio
Lee Lime Co., Lee, Mass.	Rockland & Rockport Lime Co., New York—Rockland, Maine—Boston	National Lime & Stone Co., Carey, Ohio	Merion Lime & Stone Co., Norristown, Pa.
Glencoe Lime & Cement Co., St. Louis, Mo.	The A. & C. Lime Co., Canton, Ohio	Ohio Hydrate & Supply Co., Woodville, Ohio	Vermarco Lime Co., West Rutland, Vt.
Hunkins-Willis Lime & Cement Co., St. Louis, Mo.	Riverton Lime Co., Riverton, Va.	Union Lime Co., Milwaukee, Wis.	

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Cut Hauling Cost

THE successful truck for use in hauling contractors' supplies and building material must be highly efficient, durable, dependable, easily operated and economical in operation and maintenance. White trucks meet these requirements from every standpoint.

Many builders supply companies have found the White 5-ton Dumping Truck to be the most efficient solution of their delivery problems. This truck may be loaded from a clam shell or hopper in a very short time and with much less waste than would be the case with a narrower body. The White Power Dumping mechanism, obtainable only on White Trucks, will dump a complete load in thirty seconds.

The performance of White Trucks in this country is so well known and their distribution so widespread that they have gained predominance in practically every line of business where transportation is involved.

H

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CLEVELAND

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	Price
1—12x7½x10 Sullivan, 2-stage, belt drive, almost new, 300' cap.....	\$ 1,200
1—10x10x12 Laidlaw-Dunn-Gordon, steam, cap. 170' per min.....	600
1—Rand Imperial, duplex, steam, 2-stage, air, 1500' per min.....	3,000
1—8½x9 Westinghouse, almost new....	150
1—12x12x16 Ingersoll, straight line, steam driven, capacity about 300' at 80 to 100 lbs.....	600
1—Sullivan, 2-stage air, simple steam, capacity 1800' at 80 to 100 lb.....	2,500
1—14x16x10x16 Sullivan, 2-stage air, simple steam, capacity 600' at 80 to 100 lb.....	1,500
1—14x9x10 Bury, 2-stage, belt driven, capacity 350'.....	1,500
1—Ingersoll-Rand, belt-driven, 2-stage, 500'.....	2,000
1—Sullivan, 2-stage, belt-driven, 1400', good as new, f. o. b. St. Louis.....	4,500

CARS

20—4-yd. Western, 2-way, contractors, 36" gauge, wooden bodies, each....	\$ 125
70—2½-yd. steel bodied, end dump quarry cars, 36" gauge, each.....	80
30—2½-yd. steel bodied, end dump quarry cars, 48" gauge, each.....	75
20—12-yd. Western, standard gauge MCB, air dump cars, good condition, each.....	900
30—1½-yd. Koppel "V"-shaped, 24" gauge, steel cars, new, each.....	120

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2—18x24 Blake jaw crusher, on skids..	3,000

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1—5-ton, 4-wheel Vulcan Bucyrus single line crane.....	\$ 5,000
1—22-ton O. & S. 8-wheel, M. C. B. 38-ft. boom.....	23,000

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	Price
1—¾-yd. Owen with teeth, almost new..	\$ 450
2—1½-yd. Hayward, first class.....	650
1—1-yd. Browning.....	500
1—1½-yd. Page Dragline.....	500
1—2-yd. Brown hoist Clam.....	800

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1—No. 9 with 36" buckets, good condition, without belt.....	\$ 900
1—Stephens & Adamson stone screen, 42"x16', with dust jacket, practically new.....	700
1—48x18 Austin screen with dust jacket	800
1—40x18 Gates screen with dust jacket	700
1—40x18 Gates screen, with dust jacket	900
6—Stephens-Adamson screens, each....	150
1—45 Gates, 30' centers.....	500

HOISTING ENGINE

1—7x10 Lidgerwood DCDD, with boiler.....	\$ 1,100
1—8x12 Mundy DCDD, with boiler....	1,300
1—9x10 Lidgerwood, 3-drum, 32" drums, without boiler.....	2,000
With boiler.....	2,300
1—Clyde 9x10, 3-drum with boiler, f. o. b. Mich.....	2,500
1—8½x12 Special Dragline Swing Engine, brand new.	
1—8½x10 Lidgerwood D. C., D. D., with boiler.....	1,750

LOCOMOTIVES

1—9x14 Porter 36 in. gauge saddle tank.....	\$ 1,400
1—9x14 Davenport 36 in. gauge saddle tank.....	1,400
1—19x24 Baldwin, 10-wheeler, 60 tons, just rebuilt.....	8,000
1—18x24 American 10-wheeler.....	6,000
1—17x24 6-wheel switcher.....	8,000
2—7x12 Davenport 24 in. gauge, each..	1,500

DRAGLINES

1—No. 3 Monighan 65 ft. boom, 3-yd. bucket, fine condition.....	\$12,000
---	----------

PUMPS

	Price
1—10" Morris, sand, belt drive.....	\$ 500
1—8" Morris, water, belt drive.....	300
1—20x10x14 Worthington duplex.....	600
1—Wilson-Snyder water works pump, complete with condenser.....	2,000

STEAM SHOVELS

1—28 Marion traction, ¾-yd. dipper...\$	4,600
1—No. 1 Thew traction, 1¼-yd., perfect condition.....	5,500
1—No. 0 Thew traction with ¾-yd. dipper, fine condition.....	4,000
1—No. 1 Vulcan revolving shovel, standard gauge with ¾-yd. dipper, good as new.....	4,500
Same as above, with 35' crane boom.....	5,500
1—45-ton Bucyrus, standard gauge, 1¾-yd. dipper.....	6,500
1—Model 60 Marion with 2½-yd. dipper	7,000
1—70-ton Bucyrus with 2½-yd. dipper..	6,250

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1—7x10 Flory steam DCDD with boiler, carriage and all fittings but no rope.....	1,950

BOILERS

2—80 hp. Erie Economic, each.....	\$ 1,000
1—25 hp. vertical American hoist and derrick.....	800
1—40 hp. firebox on steel truck.....	550
1—50 hp. vertical butt strap.....	750
1—60 hp. vertical Lidgerwood.....	800
2—250 hp. Marine type, 150 lb., each..	3,500

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1—20 hp. Westinghouse, 60 cycle, 3 phase, 220 volt.....	\$ 400
1—30 hp. Westinghouse, 60 cycle, 3 phase, 2,200 volt.....	500

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Marion Model No. 20 with 1 1-4 yard dipper as good as new. Can make immediate shipment.

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**LOCOMOTIVE CRANES
STEAM SHOVELS
LOCOMOTIVES
CARS
RAILS
HOISTING ENGINES
GRAB BUCKETS
STONE CRUSHERS
COMPRESSORS
ETC.**

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18-24 in. gauge 3-deck steel cars and 1 transfer for handling cement block or hollow wear; 1 "Blake model" 9-in. x 15-in. Jaw Crusher; 12 tons 16-lb. steel T rails; 1 "Excelsior" hand tamp; 10 cement brick machine.

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Owned By Us and Sold Under Absolute Guarantee

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- 1—Standard 70-ton Bucyrus, shop No. 733, 2½-yd. dipper.
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- 22—12-yd. standard gage Western air dump cars.
- 2—12-yd. standard gage Oliver side dump cars.
- 9—6-yd. standard gage K. & J. side dump cars.
- 60—4-yd., 36-in. gage Western.
- 30—1½-yd., 24-in. gage.

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- 1—18x24 cylinder, 10-wheel locomotive, weighing 55 tons, with 42 tons on drivers; built by American Locomotive Co. in 1907; steam pressure 170 lb., rigid wheel base, 10 ft. 2 in., wheel centers 44 in. in diameter. Most modern locomotive receiving general overhauling.
- 1—18x24, 10-wheel Baldwin, weighing 54 tons, with 42 tons on drivers; steam pressure 180 lb., diameter of driving wheel centers 50 in., rigid wheel base 13 ft. 10 in., overhauled Oct., 1917. First-class condition.
- 2—Standard gage 10x16 Davenport Saddle tank locomotives, weighing 19 tons, 1 65 lb. steam pressure, steam brakes and automatic couplers; locomotives built in 1917. Good as new.

- 2—Standard gage Davenport Saddle Tank Locomotives, weighing 18 tons, 150 lb. steam pressure, steam brakes and automatic couplers.
- 10—36-in. gage, 10x16 and 9x14 Davenport saddle tank locomotives.

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- 1—Carload 4½-in., 5-in. and 5½-in. spikes.
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- 10 tons 20-lb. rail with splices.
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- 3—Brownell, 72 in. x 18 ft. Horizontal Tubular Boilers, with 4-in. tubes.
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- 1—16 x 16 x 18-in. Laidlaw-Dunn-Gordon Air Compressor with reservoir, weight 15,000.
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Standard, Electric, 60-ton, with 2½ cubic yard dipper; capacity 250 cubic yards per hour, fully equipped with electric motors and automatic control throughout; operates with 2,200 volt or 440 volt; 3 phase, 60 cycle current; mounted on standard 8-wheel M.C.B. trucks. PRICE \$25,000 f. o. b. cars in California. All in first-class working order, ready for immediate delivery.

Also, one

INSLEY DRAGLINE EXCAVATOR

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PRICE \$3,000 f. o. b. cars in California.

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A highly competent and efficient chemist with ten years' experience as chief chemist and superintendent wishes to communicate with a company having such a position open. Address C. D., c/o Cement and Engineering News, 672 Transportation Bldg., Chicago.

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Wanted, for large cement plant, chief engineer familiar with Corliss engines and all power house equipment. Must have thorough knowledge of stokers and combustion of fuel. Please state age, position in draft, previous experience, references and salary expected in first letter. Address Box 69, care Cement & Engineering News, 672 Transportation Building, Chicago.

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For wet process Cement Mill in Middle West, by January 1, 1919. Must be competent mechanic and engineer, capable of taking full charge of 2,000-barrel mill. In replying, state fully—age, experience, reference, where last, or at present, employed, and salary expected. Address Box 22, c/o Cement and Engineering News, 672 Transportation Bldg., Chicago, Ill.

CHEMIST WANTED.

Competent cement chemist wanted to take charge of laboratory; advise age, experience, reference and salary considered. Address Box 22, care Cement & Engineering News, Chicago, Ill.

Wanted: Complete second-hand cement plant, machine shop and laboratory outfit; must be in first-class condition. Address R. C. C., care of Cement & Engineering News, 672 Transportation Bldg., Chicago.

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With fifteen years' experience, the last twelve as chief chemist, desires position. Address Quimico, c/o Cement and Engineering News, 672 Transportation Bldg., Chicago, Ill.

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Wanted—Superintendent or assistant superintendent who has had cement mill and quarry experience, to take charge of a large lime and stone crushing plant. Must be a hustler and good practical man, able to handle several hundred men. Splendid opening for the right man, with an excellent future. Man with cement mill experience preferred. State fully previous experience, reason for desiring change, and salary expected. Apply Box J. B., care Cement & Engineering News, 672 Transportation Building, Chicago.

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Superintendent for Cement Plant. Located in Lehigh Valley; 2,000 bbls. daily capacity. Must be available Jan. 1st or before. Write fully, giving experience, references, age and salary expected. Address C-C-H, c/o Cement & Engineering News, 672 Transportation Bldg., Chicago, Illinois.

Wanted immediately, by cement plant located near city, experienced Quarry Foreman. Permanent position. Write stating experience, whether married or single, and salary expected. Address Box K. P., care Cement and Eng. News, 672 Transportation Bldg., Chicago.

WANTED.

Mechanical Engineer with experience in cement industry wanted for large cement plant in East. State past experience and salary expected. Box 692 c/o Cement and Engineering News, 672 Transportation Bldg., Chicago.

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I am in the market for the following second-hand (good condition) equipment: One 250 h. p. return tubular boiler; 5½ kilometers portable track, 16 to 20 lb. rails, 30" gage; one small locomotive, about 8 tons; 20 side-dump cars. W. J. Carmichael, Wiloughby, Ohio.

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Complete second-hand modern concrete tile and block plant; good capacity, in good working order. Providence Farms, Inc., Moyock, N. C.

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NEW LOCOMOTIVE CRANE

One Link-Belt 20-ton, 8-wheel, 50-ft. boom, 1½-yd. clam shell bucket. M.C.B. Immediate shipment. New in July, 1918.

50-TON LOCOMOTIVE

American Locomotive Co. 4 wheel, saddle tank, standard gauge air brakes. New in July, 1918.

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Four 12 yard Western wheel scraper hand dump cars. M.C.B. condition.

Located at Benton Coal Company Mine, Benton, Ill.

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CARLIN'S
SHEARS DERRICKS
GRINDING PANS
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"AMPERE"

(Canvas Stitched)

"WHITE SEAL"

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From Tabulated List of

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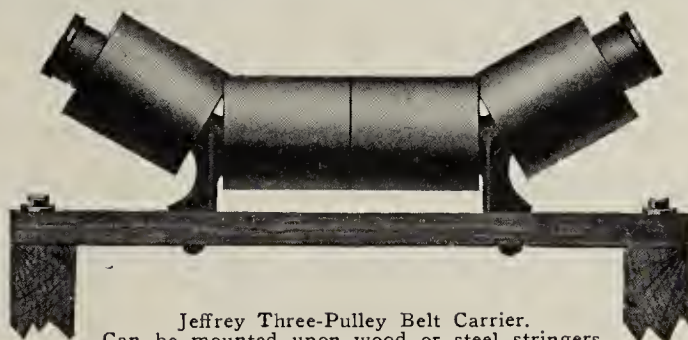
In Our New Catalog

Jeffrey Standardized Belts, Carriers and Trippers are the result of years of close personal contact in building conveying equipment to meet all kinds of operating conditions, and therefore are a composite of the best of materials and practical engineering service.

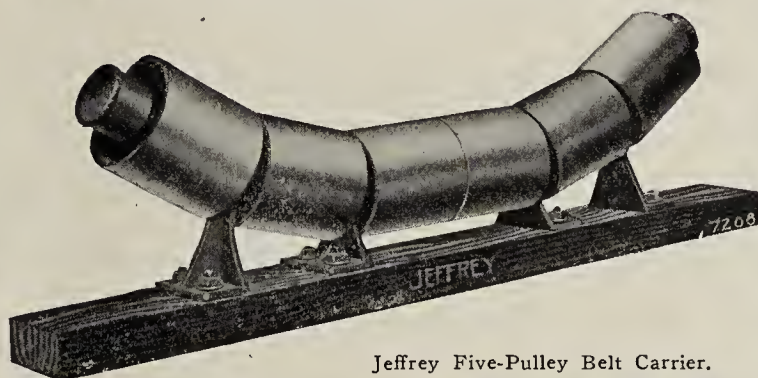
Catalog No. 175-C has valuable data that every engineer, contractor or manufacturer should have. Write for copy.

The Jeffrey Mfg. Co.

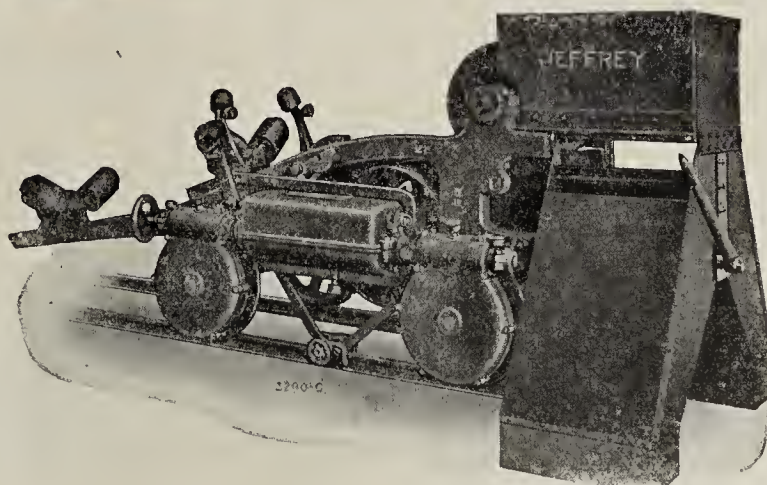
914 North Fourth Street
Columbus, Ohio



Jeffrey Three-Pulley Belt Carrier.
Can be mounted upon wood or steel stringers.



Jeffrey Five-Pulley Belt Carrier.



Jeffrey Self-Propelled Automatic Reversing Belt Tripper.

CEMENT AND ENGINEERING NEWS

with which Gravel & Stone Magazine is incorporated

(PUBLISHED MONTHLY)

William Seafert, *Publisher and Editor*J. F. Waldron, *Advertising Manager*R. M. McCully, *Business Manager*

Office—672 Transportation Building, Chicago

Telephone, Harrison 5337

Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, \$1.00 per year; all
other countries, \$1.50 per year.
Single Copies 20c.

DISCONTINUANCES—The greater part of our subscribers prefer NOT to have their subscriptions interrupted, in case they fail to remit promptly for renewal. It is therefore assumed, unless notification is given to the contrary, that the subscriber wishes to continue taking our paper. Therefore CEMENT & ENGINEERING NEWS will be sent until we are notified to discontinue—Such notice should be sent when the subscription expires.

Advertising copy or changes in ads. must be in this office by the 25th of each month, as hereafter our magazine will appear on the 5th of the following month

Advertising Rates Sent on Application

Vol. 31 CHICAGO, FEBRUARY, 1919 No 2

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SAUERMAN

DRAGLINE CABLEWAY EXCAVATOR

*used in connection
with screening plants
for preparing and
sizing road material*

The cost of road construction begins—not with the actual work on the road—but with the first move which is made to get materials ready for the job.



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Write today for literature and illustrated catalog which shows the wide adaptability of this excavator which will accomplish the digging, conveying, elevating and dumping all in one continuous operation.

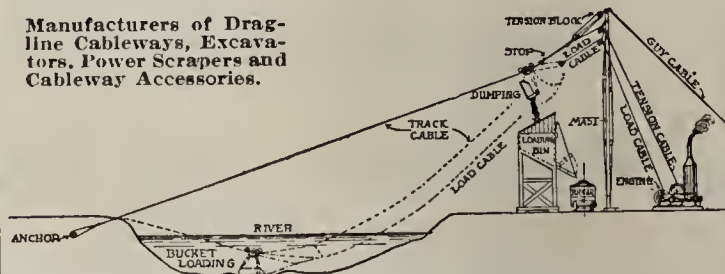
Under the control of one operator

SAUERMAN BROS.

1139 Monadnock Block

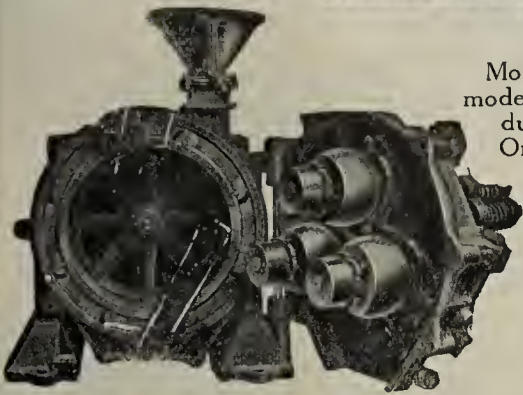
Chicago

Manufacturers of Drag-
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tors, Power Scrapers and
Cableway Accessories.



STURTEVANT MILL CO.

HARRISON SQUARE - - BOSTON, MASS.



Ring-Roll Pulverizer

RING-ROLL PULVERIZERS

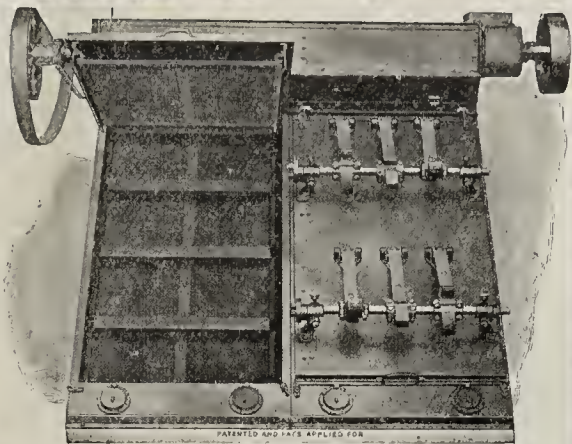
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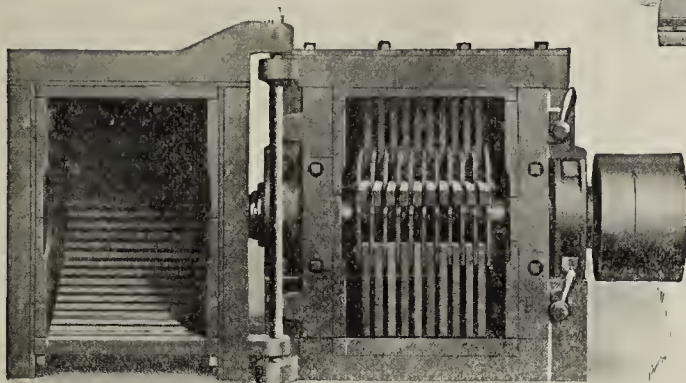


Newaygo Super-Screen

SWING-SLEDGE MILLS

The greatest producers known on Limestone, Lime, Shells, Chemicals, Talc, Clay, Chalk, Bark, Rosin, Sulphur, Coal, Salt, and many other moderately hard and soft materials. High Speed Pulverizers, crushing by a series of blows delivered at high speed against the material fed into the machine.

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Swing-Sledge Mill

WE MAKE THE
LARGEST COMPLETE

LINE OF
CRUSHING, GRINDING,
SCREENING, WEIGHING,
SACKING, ELEVATING
AND MIXING MACHINERY

IN THE WORLD

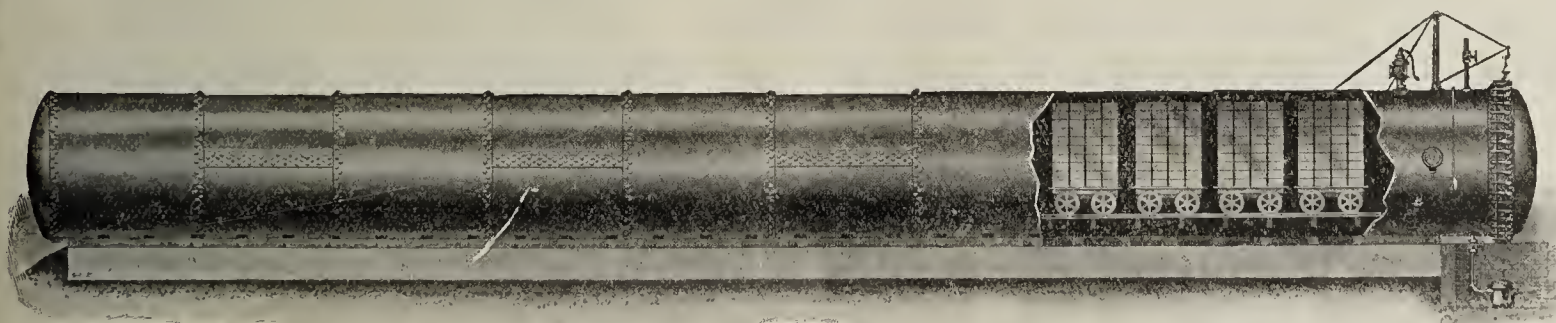
Send for Condensed Circular No. 60

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Our complete line of Sand Lime Brick Machinery makes it possible to secure just that machinery which is required to make your plant a success. We favor no particular type of machinery but are guided by the needs of the customer. Our wet and dry grinding mills have transformed a number of unsuccessful plants into dividend producers, while our Presses, Mixers, Hardening Cylinders and other equipment are of equal quality. We can exactly meet the demands of any manufacturer with a quality of machinery which will operate at a profit with a minimum amount of attention and expense.

Correspondence solicited

The American Clay Machinery Co.
WILLOUGHBY, OHIO





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Can you tell the difference?**

You could see the difference pretty quickly if you had both at work on a machine
One of them is made of

STROH STEEL PROCESS

The other is—just steel. The difference is in the way they wear. The work they do.
“Stroh” Gears and Pinions will so far outwear those made of any other material that
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money. Write us now while you think of it.

Stroh Steel Hardening Process Co.
PITTSBURGH



This belt is built to meet just such wearing con- ditions as you have in your cement plant

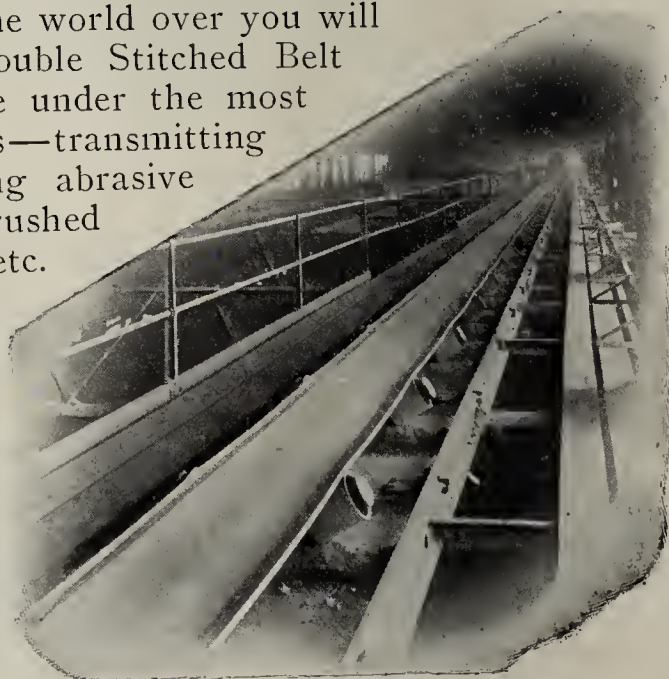
In mines and mills the world over you will find Black Giant Double Stitched Belt giving record service under the most severe conditions—transmitting power and conveying abrasive materials such as crushed stone, sand, gravel, etc.

Two cement companies alone bought during 1917 over Fifty Thousand Dollars' worth of Black Giant Double Stitched Belt.

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McILROY BELTING & HOSE CO.

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Black Giant Runs True and Even—No Spillage.

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DU PONT**EXPLOSIVES****Standards for 117 Years**

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The magnitude of this accomplishment is better appreciated when you consider the increased activity of all fuel and ore mines, quarries and emergency construction operations.

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E. I. du Pont de Nemours & Co.

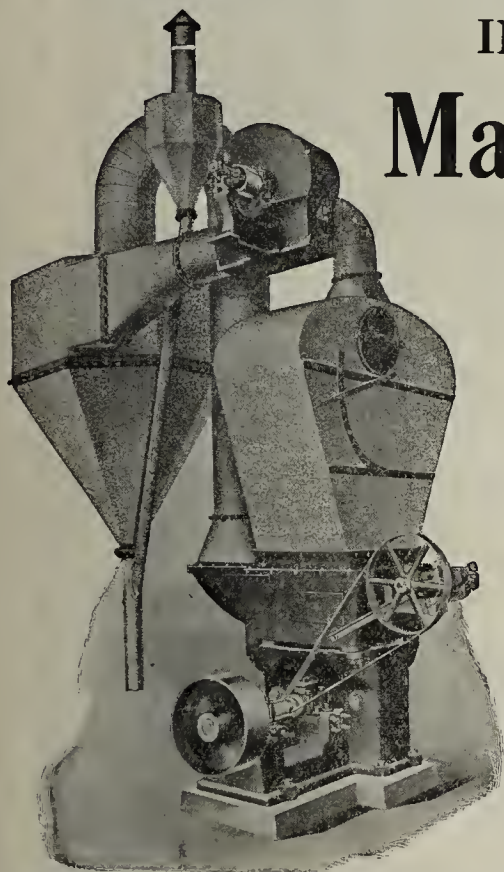
POWDER MAKERS SINCE 1802

WILMINGTON

DELAWARE

DU PONT

Complete Grinding IN ONE Machine



In successful use
grinding
Cement, Clinker,
Limestone, Coal

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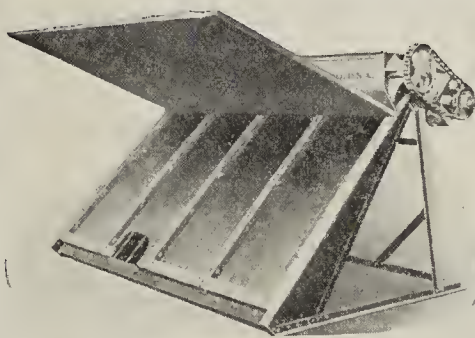
NO DUST

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National Screen Separator

THE LEADING SCREEN IN



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Durability
Simplicity**

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Electric Drive

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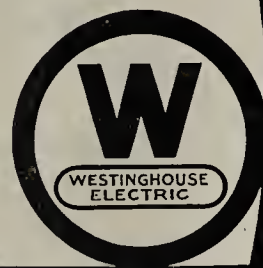
Cement Mill

—possesses many time, labor and money-saving possibilities, that are revealed only by practical application to your individual plant conditions.

When you back up your electric drive with

WESTINGHOUSE MOTORS

—you are assured of unsurpassed efficiency and reliability.



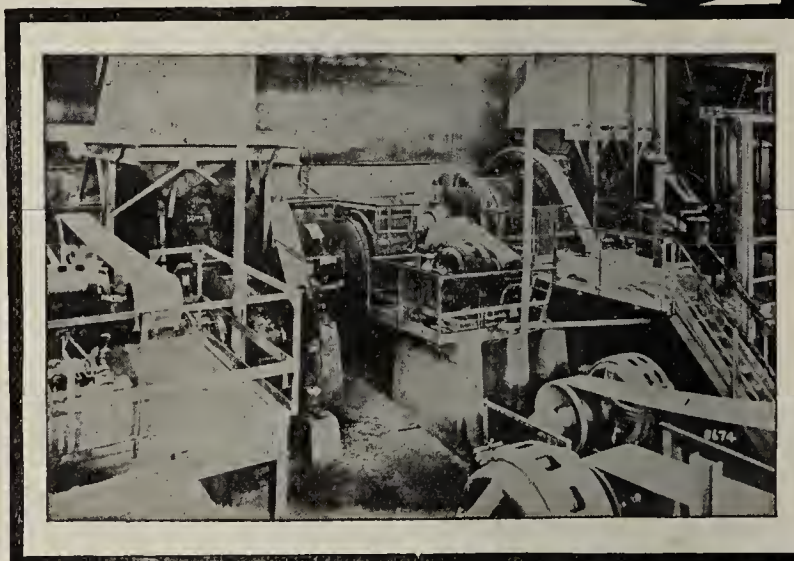
*Westinghouse C S Motors driving Ball Mills at
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Westinghouse Service provides you with the knowledge and ability of a corps of experts with an intimate knowledge of your work.

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WESTINGHOUSE ELECTRIC
& MFG. CO.

EAST PITTSBURGH, PA

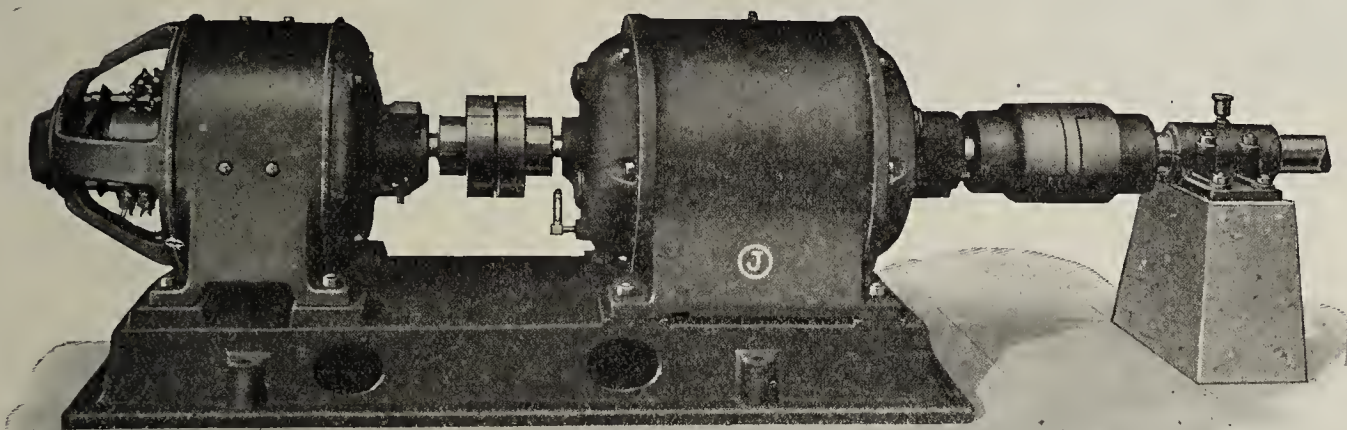


Westinghouse



The JONES SPUR GEAR SPEED REDUCER

Particularly Adapted to
CEMENT MILL DRIVES



THE Jones Spur Gear Speed Reducer is just a plain spur gear drive, but fully enclosed in a strong, compact, dust proof housing with all moving parts protected and operating in a bath of oil.

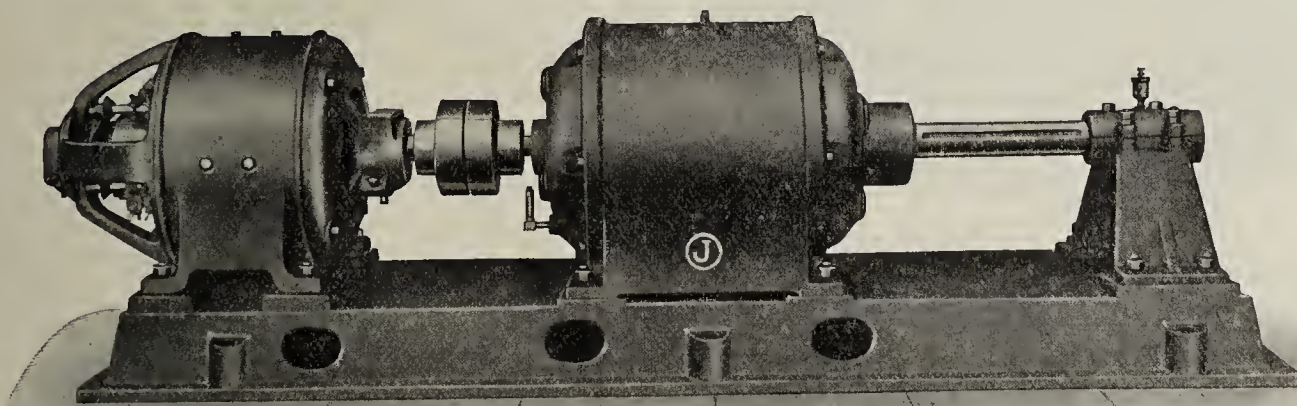
True, the arrangement of gears is unique, but nevertheless extremely simple, practical and mechanically correct in every detail.

All reductions are accomplished by means of spur gears forged of special analysis steel and finished all over. The teeth are accurately generated of the stub involute form with twenty degree pressure angle. No internal gears involving a complicated mounting are employed.

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The motor shaft and bearings are relieved of all transverse loads, as direct connection to the reducer is made through a flexible coupling.

Our Engineering Department will welcome the opportunity of giving you further details. Each speed reducing problem is given a complete engineering analysis.



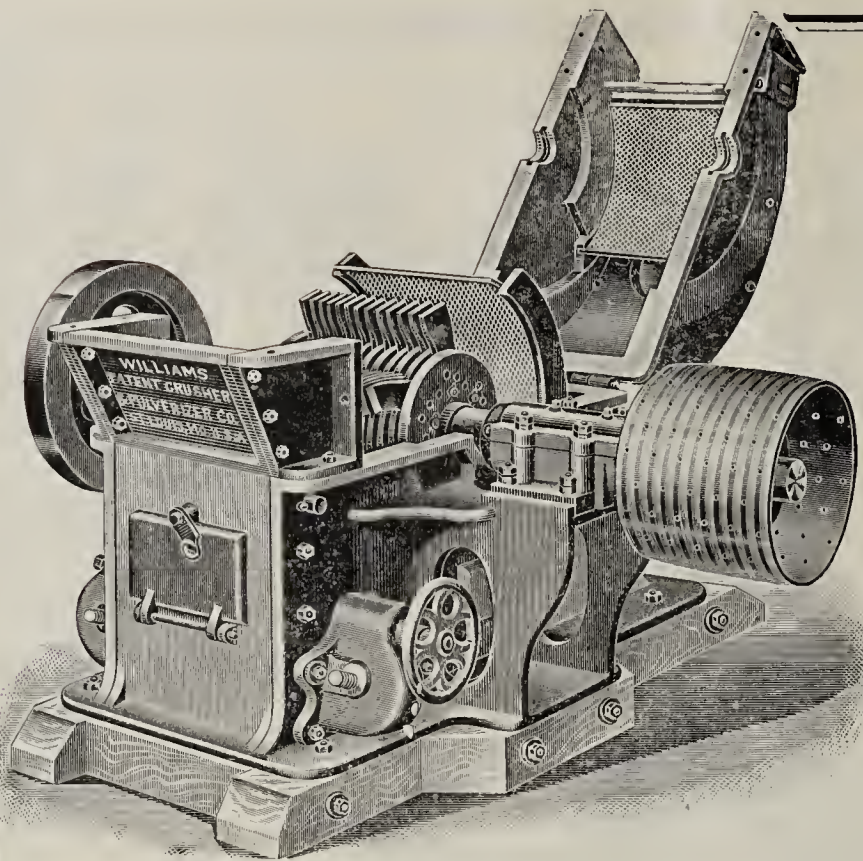
W. A. JONES FOUNDRY & MACHINE CO.

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LIMESTONE GRINDERS

Take 2 in. to 3 in. dry stone and in one operation, without outside screens or separators will produce 95% through 20-mesh material.

**CAPACITIES RANGE FROM
1/4 TO 30 TONS PER HOUR**

**Over 5,000 Williams Mills in Daily
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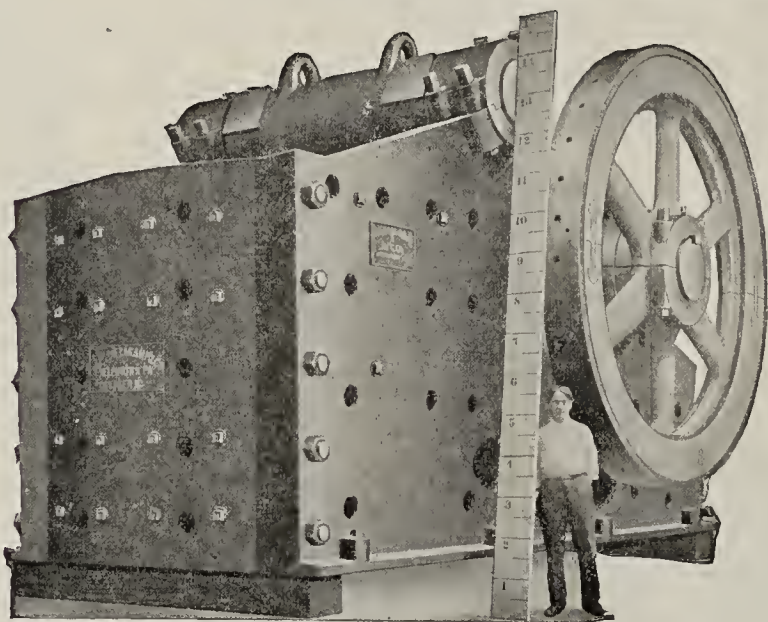
There is undoubtedly room in your plant for one of these machines, which, in the last twenty-two years have proven that they are money savers, can be depended on, and really have merit. If further information is desired, Write for Bulletin No. 17, which is brim full.

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The last word in Gyrators.

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They eliminate the personal equation in auto-
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Long or short for wet or dry grinding. Have
water cooled bearings of extra size. Positive
automatic feed that assures maximum tonnage
for minimum horse power.

The Traylor Ball Tube Mill

For reducing lumps to fines in one step.

**"THE ULTIMATE
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"WE ARE GLAD"
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SYMONS DISC
Crushers

We have been using these crushers for the past six years along with other kinds. We have several gyratory crushers in different sizes and have used rolls. For the purpose which we are using the discs, we think there is no machine any way near their equal. Signed: F. D. Coppock, Pres. and Mgr., THE GREENVILLE GRAVEL CO., Greenville, Ohio.

Equip Your Gravel and Crushed Stone Plant
with a

Symons Disc Crusher

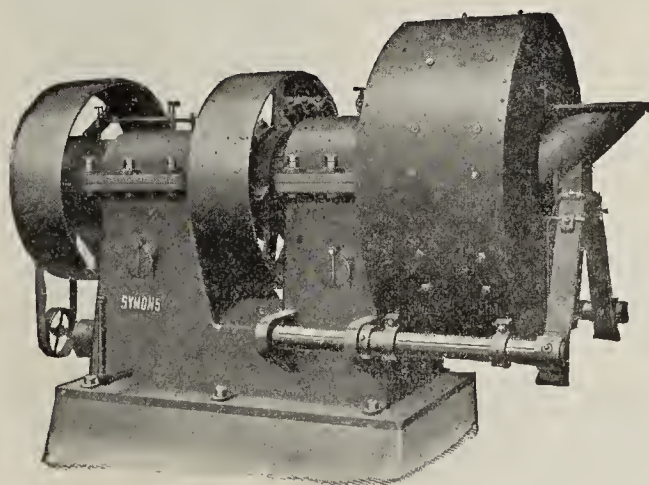
It will increase your output, lower your costs and deliver a more uniform material. Built in four sizes: 18 in., 24 in., 36 in., and 48 in. Capacities from 5 to 120 tons per hour.

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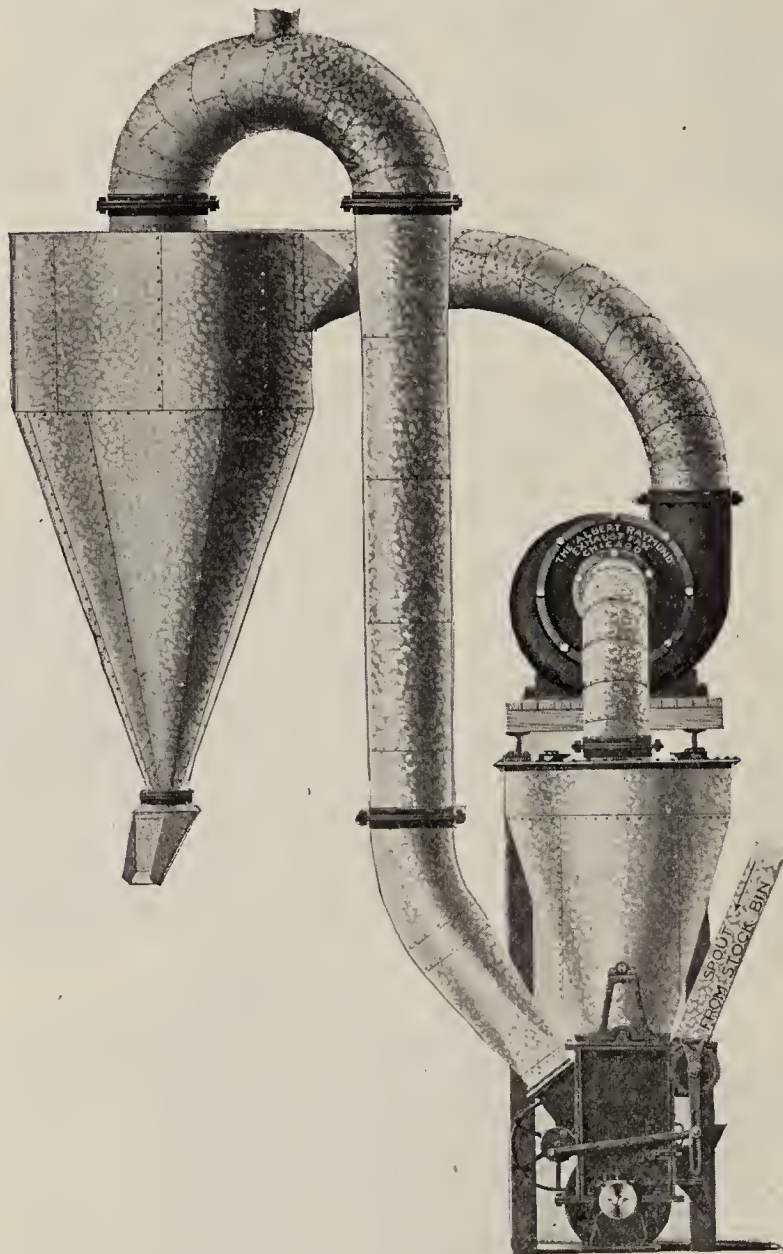
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Regardless of whether you use the *CLYDE*, *KRITZER*, *SCHAFFER*, *LAUMAN* or any other type of *HYDRATOR*, no matter how efficient or crude, the *RAYMOND AUTOMATIC PULVERIZERS* equipped with *AIR SEPARATION* and *AUTOMATIC THROW-OUT ATTACHMENT* will give you a fine smooth finished *HYDRATE* which will not blister in wall plaster.



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Then write us for information about the Raymond System, which has become the standard in many lime plants.

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FOR MOST EFFICIENT FINE GRINDING **CONCAVEX**

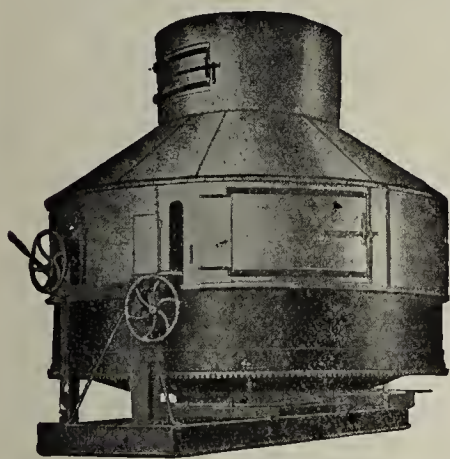


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Hydrating Plants Equipped With The **CLYDE LIME HYDRATOR** Are an Assured Success



Clyde Hydrator with Hood
"The common sense way"

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This up-to-date and successful Hydrating Plant was placed in operation last summer. It was built and designed by Richard K. Meade & Co., Engineers, Baltimore, Md.

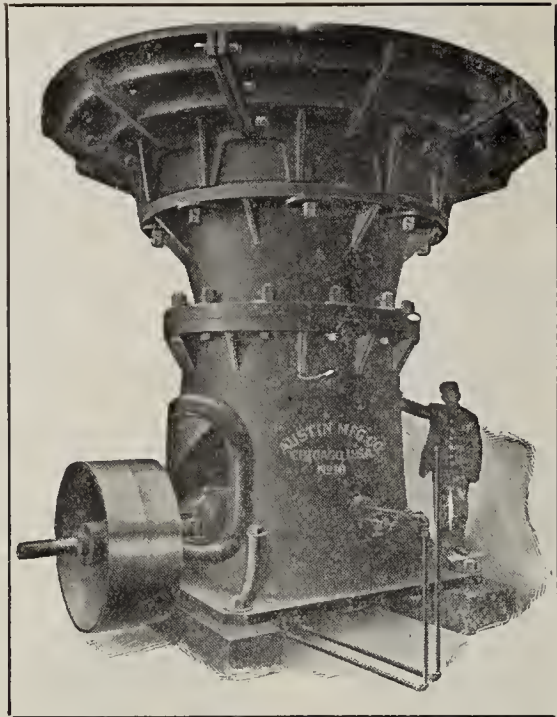
The Clyde Hydrator has become standard equipment. It always turns out a uniform product.

The Clyde makes perfect hydrate of either high calcium or dolomite lime. Low in first cost, simple to install, economical to operate.

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Austin Crushers, Elevators and Screens are made in many sizes and capacities—Both Stationary and Portable Types.

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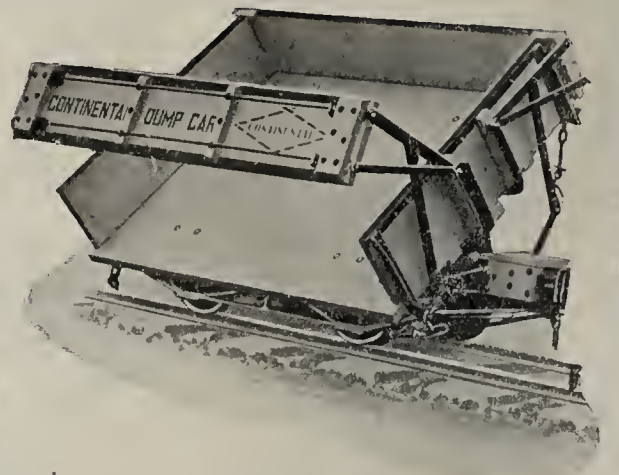
Rock Crushers	Combined Sweeper-
Portable Stone Bins	Sprinkler
Stone Elevators	Motor Tandam Rollers
Stone Screens	Motor Macadam
Road Rollers	Rollers
Horse Drawn Rollers	
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CONTINENTAL DUMP CARS

are noted for correct design, sturdy construction, highest grade of materials and workmanship, and they incorporate many new features not found in other cars.

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FIND IT INDISPENSABLE IN
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DOES THE WORK OF FROM
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MOVING —

**OVER 50% OF
USERS SEND US
"REPEAT"
ORDERS**



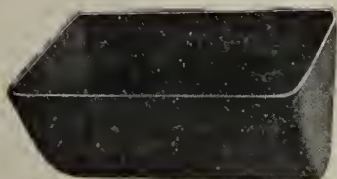
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MACHINERY CO., INC.**
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Any size, style and shape, for all classes of elevator systems. Ask for details.



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for handling abrasive, gritty and corrosive materials. So constructed that pins cannot rock or rotate in side bars. Means longer, better service. Runs on standard sprockets. One of many types. Particulars on request.



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Built in various types and sizes for handling different classes of materials. Write for details. Tell us the nature of material you wish to convey.

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Buffalo . . . 696 Ellicott Square
Wilkes-Barre, 2d National Bank Bldg.
Cleveland . . . 429 Rockefeller Bldg.
Detroit . . . 732 Dime Bank Bldg.
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CHICAGO

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San Francisco . . .
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Minneapolis, Link-Belt Supply Co., 418 S. Third St.

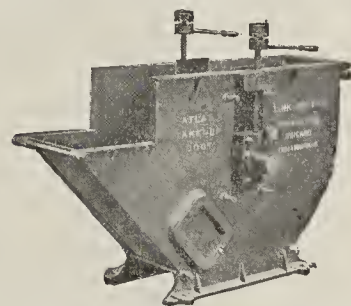
INDIANAPOLIS

576 First Ave., S.
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161 and 163 N. Los Angeles St.
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Furnished in many sizes and types, with or without stands, to handle light or heavy materials.



Link-Belt Elevator Boots

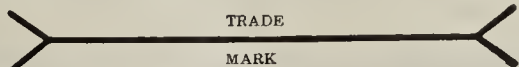
Made in various types to suit conditions.



Ewart Detachable Link-Belt

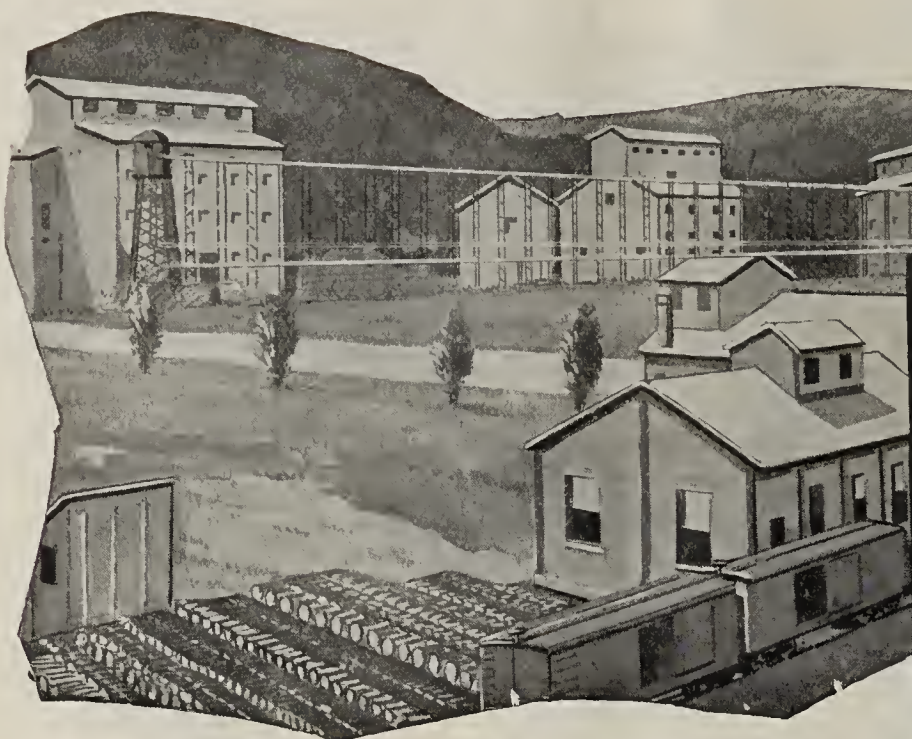
A good, strong, reliable form of Link-Belt for light and medium service. Adapted to a wide variety of uses.

THIS TRADE MARK APPEARS
ON ALL LINK-BELT EQUIPMENT



LOOK FOR IT. IT IS OUR PLEDGE
OF QUALITY AND EFFICIENCY





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Put your blasting problems up to us

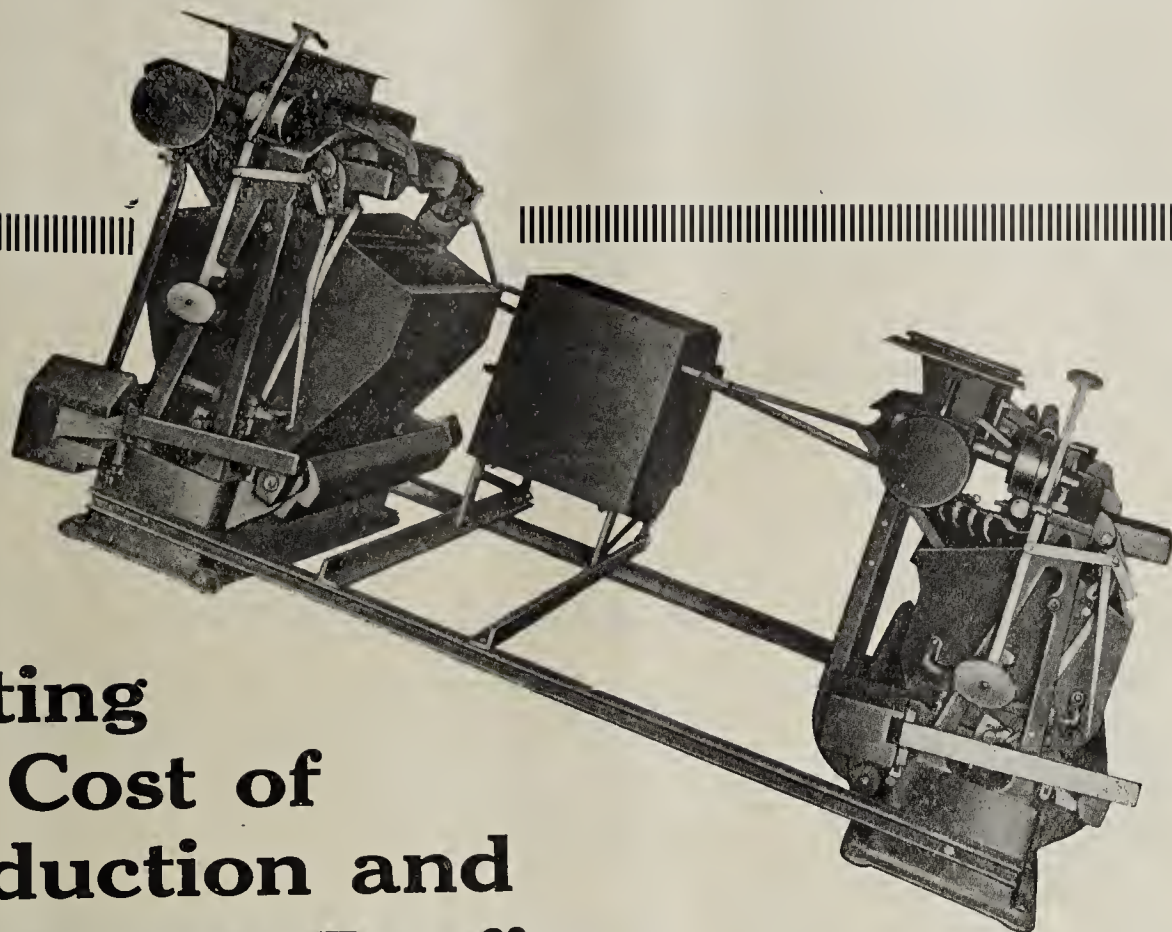
Our Service Department is a clearing house of blasting experience in all its phases and under all conditions. It is directed by experts who will personally help you apply this vast store of information to *your own* blasting. WRITE TODAY.

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Cutting the Cost of Production and Increasing Profits

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They are not an experiment.

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Labor is saved. Accuracy obtained.

Our line of guaranteed automatic weighing and packing machines is of the highest grade.

We lend expert co-operation in *plant arrangement* to accommodate an equipment.

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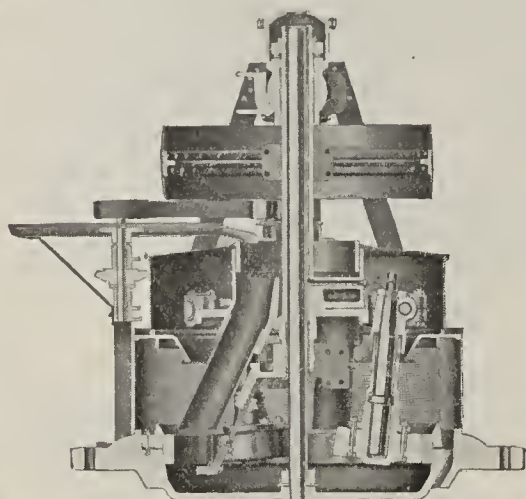
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AS A preliminary pulverizer of cement rock, limestone and clinker, has demanded investigation of its merits. Most of the progressive cement manufacturers are either buying or investigating this machine. It is surprising to know how many of these mills are in successful operation and more surprising to note its tremendous output, extreme fineness, low horse-power consumption and exceptionally low maintenance cost. Why not let us send list of installations, or one of our engineers, to show you how much more efficient this mill is than your present preliminary machines?



This mill has taken its place as the most economical preliminary machine ever used in the cement or agricultural limestone plant.

Let us give you complete data on its performance for the last five years—it's yours for the asking.

Twenty-two mills sold without advertising—a record unequaled in the cement industry.

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A standard rotary kiln would not serve every purpose or process.

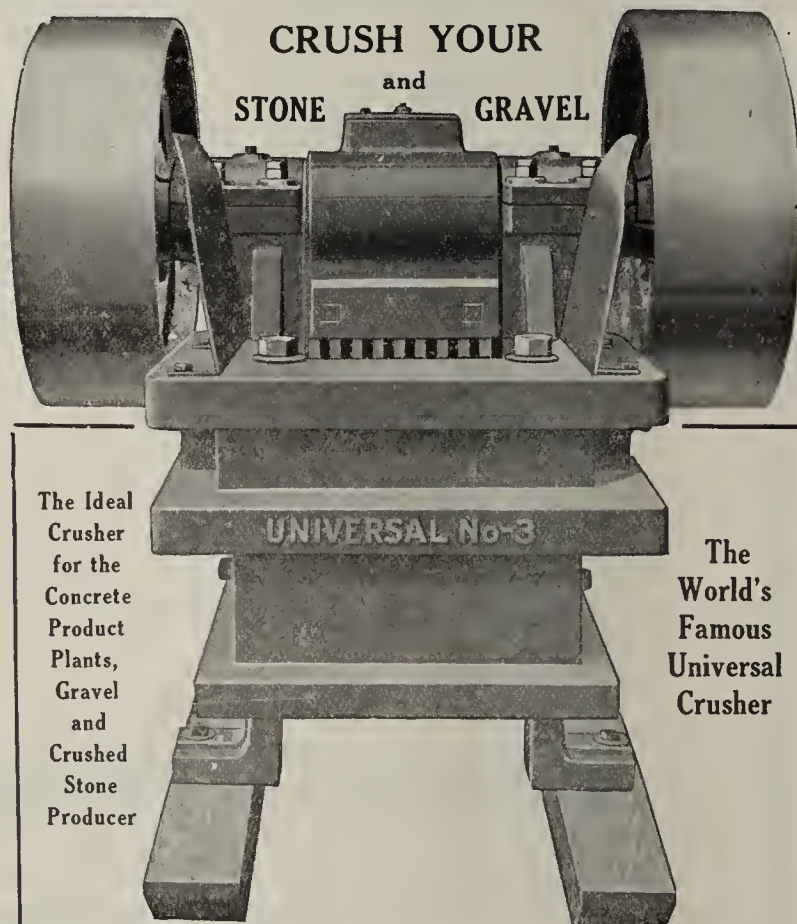
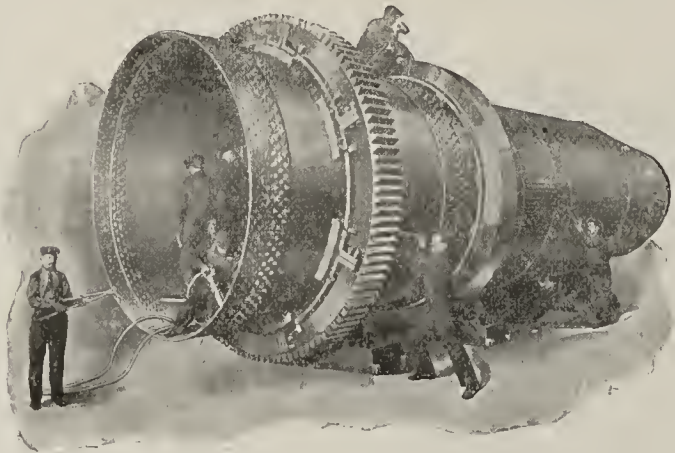
In building Vulcan Kilns we make the design meet the individual requirements of product, and operating conditions.

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We Build Crushers from 5 Tons to 300 Tons per 10-hour Capacity

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230 Bee Ave

Cedar Rapids, Iowa, U. S. A.

Cement and Engineering News

Vol. 31

Chicago, February, 1919

No. 2

Concrete Roads

I SIT me down to write an ode about the great ideal road. In these uplifting modern days we've found the punk thing never pays. The coin we've wasted making roads which wouldn't stand beneath our loads! That coin would buy us battleships till all the navies we'd eclipse. That silver coin, if stacked on end, would reach the good old moon, my friend.

We made our dizzy thoroughfare, and then were busy with repairs; the more we fixed the dad-blamed things, the more they needed help, by jings. But now there's no excuse for such, for wasting wealth to beat the Dutch. The concrete road has shown its worth; it is the greatest thing on earth. It solves a hundred problems that once jarred the thought works in your hat.

Its cost is low—and that's worth while, since saving money is the style; and when it's built it's built to stay—it will not blow or wash away. It's pleasant, sure, to have a pike on which to travel when you like, nor find it wound around a hedge, nor buckled up, nor stood on edge. The concrete road is always there, and seldom clamors for repair, and all the scientists agree as to its durability.

Its surface smooth, you haul a load you couldn't on another road, and every parasang you go, you're saving time, and likewise dough.

Good roads! You hear that slogan sound, wherever you may jaunt around. Go east or west, or north or south, you'll hear that cry from every mouth. For now the people have grown wise, and thoroughly they realize for better roads we all must yell, if we'd reduce H. C. of L. It needs no diagrams to show that better roads make prices low; consumers save a yen or more, on things delivered at their door.

Since for good roads we make behest, and since the concrete roads are best, the argument is at an end; we must have concrete roads, my friend.

WALT MASON.

Editorial

Proposed Freight Rates on Sand, Gravel and Crushed Stone Threaten Road Building Plans

The railroad administration is considering a plan to increase substantially the cost of highway construction. It is in the form of an increased freight rate on sand, gravel, crushed stone, cement and slag. The boost is said to average between 25 and 40 per cent. Some increases are less than 10 per cent, while others are over 100.

If the plan goes through, road construction will probably be decreased, and consequently there will be less employment for returning soldiers.

"If it goes through," said S. E. Bradt, state highway commissioner of Illinois, "Governor Lowden will hesitate a long time before he starts spending the \$60,000,000 for good roads in Illinois."

"We have a bond issue of \$50,000,000 for good roads on which we will vote at the April elections," said J. H. Bateman, assistant highway commissioner of Michigan. "The freight increase will play havoc with our program."

These men were talking before the central district freight traffic committee of the federal railroad administration at a hearing in the Hotel La Salle on January 30th.

Resolutions protesting against the proposed increase, which had been adopted by the National Crushed Stone Association, were laid before the committee.

Ohio, Indiana, Michigan, and Illinois had official representatives present. Subdivisions and organizations of these gave an audience of about 400 objectors.

H. C. Barlow of the Association of Commerce, Dale F. Stansbury, assistant attorney general of Indiana, O. P. Gothlin of the Indiana public service commission, and B. F. Affleck of the national federation of building industries were other prominent objectors to the proposed increase.

The resolutions of protest of the legislatures of Ohio, Michigan, and Indiana were read to the subcommittee of the railroad administration.

One speaker after another took a broad, hard slap at the railroad administration. It was represented:

"The president of the United States, the ex-secretary of the treasury and director general of railroads, the secretary of labor, and other officials are urging immediate action in connection with public work for the unemployed and the returning soldier who is worthy of his hire. It seems inconsistent that the railroad administration should take action which will defeat and curtail the efforts of other departments.

"The rates now are remunerative. Traffic is light and the greater the volume of business the more revenue there will be for the railroads. There is at present a large surplus of open cars which can be used in this traffic and which otherwise will probably remain idle.

"The railroads should do their share in reconstruction. Manufacturing interests are not raising prices. Prices on many articles are being reduced. The existing rates, which have been materially increased several times in the last two years, are sufficiently high. An advance would discourage the great reconstruction programs. The railroad administration should encourage them."

The Ohio legislature resolution, which is typical of

the others, "respectfully but most urgently requests the president of the United States, congress, and the railroad administration to take such action as will immediately and effectively prevent an upward revision in the freight rates upon materials entering into the construction of public works."

"Here is the way I figure out the proposed rates," explained Commissioner Bradt. "We will ship a ton from Janesville to Park Ridge, a distance of ninety-eight miles. The price was 30 cents until last June. Then the cost was raised to 50 cents, and now it is proposed to raise it to 95 cents.

"You can figure out how much that means in road construction when you estimate that 6,000 tons must be used to each mile. With the increase in rates last June the cost of the Illinois road program was raised from \$60,000,000 to \$64,000,000. This proposed raise adds on at least \$4,000,000 more.

"Take a ton from Joliet to Springfield, 148 miles. It cost 53 cents until June, then 70 cents, and now it is proposed to make it \$1.20. Another illustration is from Racine to Evanston, fifty-two miles. The increase was from 40 to 60 cents last June, and the proposal is for 85. The raise from Joliet to Pontiac, fifty-five miles, is from 47 cents to 70 cents, and now to 85 cents."

Assistant Commissioner Bateman from Michigan had applied the rates to the construction of the Detroit-Monroe road, constructed last year. "The freight on the sand and gravel for this job cost \$2,400 a mile before June, when the cost was increased to \$3,200, and now it is proposed to make it \$5,200," he said.

"This proposition will throw a wet blanket over construction of public works," said John M. Glenn of the Illinois Manufacturers' Association. "Instead of encouraging activity, this would discourage it. The proposal was a serious error."

Big Cement Demand in Sight

"Like other industries not wholly necessary to the prosecution of the war, the cement industry suffered a natural curtailment of output in 1918 because of the various restrictions imposed by the several government agencies for winning the war," said H. Colin Campbell of the Portland Cement Association.

"With the removal of restrictions and the disbanding of these government agencies there is every evidence that as soon as the actual construction season may be opened postponed projects, among which are public works of all kinds, as well as many private enterprises, will be resumed or replanned.

"It seems likely that no construction movement will gain such impetus nor reach such magnitude as the insistent demand for better roads. And while, of course, not all highway improvement will be done with concrete, the admirable service rendered by this type of highway has proved by the manner in which it stood up under the great motor traffic developed by the war, has forcibly driven home to the users of roads, and particularly to the users of trucks and cars, the fact that the concrete road delivers 100 per cent of service and utility.

Billion for Roads

"State and in some cases county road bond issues are talked of or projected in a sum total that seems likely to closely approach a billion dollars before 1919 will have drawn to an end. That concrete will figure largely as a construction material in many, if not all, of these projects seems logical.

"There also is likely to be, as soon as the season will permit, a general resumption of building activities. Delayed real estate projects will be revived. Hotels, theaters, hospitals, office buildings and lastly dwellings, few of which have been built during the past two years, will be in the market for cement.

"Railroads, due to a long period of overburdening with traffic and suffering from delayed maintenance, would seem to come in for renewals and betterments and general reconstruction. All that remains in this field is an early establishment of their status, so that construction may proceed with organized certainty.

Lower Prices Gradually

"Because of depleted stocks of practically all raw materials and foodstuffs throughout the world, it is likely that such shrinkage of values as takes place will be gradual and extend over a reasonably long period, thus safeguarding against panicky conditions.

"Our country was never more prosperous, if we accept bank assets and individual wealth as an index. We are probably the largest creditor nation in the world and are debtor only to our own people. The few years just ahead of us should see a larger volume of business done in all construction fields and in industry and commerce, which includes agriculture, than any similar period in the past.

"While prices are relatively high, measured by the exchange value of most basic products, raw materials can today be exchanged or worked into finished product at such a value as to make cost of building of almost any kind lower than ever before. This fact alone should make better times than we have ever known and be the greatest stimulus that the resumption of all kinds of construction could have."

Why Stucco Crazes

The crazing or hair-cracking of stucco is a very common complaint, and rather discouraging to many owners of stucco-covered buildings, inasmuch as a crazed stucco will ruin the beauty of any successfully designed building. The reasons for the crazing of stucco vary; but the principal cause is the lack of knowledge of the proper methods of proportioning the mixture and applying the material, and finally protecting the finished stucco from the elements until it has properly hardened.

Cement applied on walls in about one-inch thickness acts very differently from the way it acts when it is poured into moulds in a compact body, and, while hardening, has sufficient dampness from the water of its own mixture. On the walls the water mixed with the cement is absorbed on the back by the ground work on which the cement is applied, and on the face by the air and wind, in a shorter time than the cement would naturally require to harden.

A stucco facing is composed of two or three coats. It depends on what finish may be desired. Naturally, the application of the cement mixture in two or three coats requires a great amount of care in order that each coat may properly adhere to the other. In the mixing of the various coats, a great deal depends on having the finish coat, which acts as a veneer over the under coat, mixed of the various ingredients in such

a way that it will act as an elastic cover—that is, that the mixture, after it has hardened, will be of a less tensile strength, and therefore less brittle, than the under coat.

The cement for the final coat should never be more than 1 part mixed with 3 parts of good, sharp, washed sand or marble grit; and also with a very small proportion of lime. This lime should be fresh-burned shell lime; if this is not obtainable, a good quality of hydrated lime may be used. This mixture (after the ground coat is well wetted down with clean water until it can absorb no more), is applied in the regular manner, and, if properly floated, will eliminate the crazing, and at the same time the lime will act as a waterproofer to a reasonable extent. This method of mixing the material and applying the same adds no extra expense to the cost of the building, and will practically insure a successful result.

New Government Bulletin Discusses Drainage Methods and Foundations for County Roads

The first essential feature of an improved road is adequate drainage, and another prime requirement, wherever a hard surface road is to be constructed, is a firm foundation. These facts are emphasized in Bulletin 724, "Drainage Methods and Foundations for County Roads," just issued as a professional paper by the Bureau of Public Roads, United States Department of Agriculture, Washington, D. C.

The purpose of the bulletin is to supply information concerning the proper methods of draining road beds constructed of various kinds of soil, and under different topographical conditions, and also to explain how foundations may be designed to suit soil conditions, the road surface and the system of drainage.

Some of the topics treated in the bulletin are primary soils, drainage, design of surface drainage, gutters, drop inlets and catch basins, subdrainage, foundations, and specifications.

American Road Builders' Association

The Ninth American Good Roads Congress and the Sixteenth Annual Convention of the American Road Builders' Association will be held at the Hotel McAlpin, Broadway and Thirty-fourth street, New York City, February 25, 26, 27 and 28, 1919.

Many problems of the most vital interest and importance are at the present time confronting the road builders of the country. It is proposed therefore, to bring together those most prominently identified with highway construction, transportation and maintenance for the purpose of considering the questions of the hour.

The program which is now being prepared for the eight sessions of the congress will be devoted to the consideration of highway transportation and the administration, financing, construction and maintenance of national, state, county and municipal highways. Papers by prominent highway authorities and reports on live topics by several committees will be presented for discussion. The general plan contemplates devoting February 25 and 26 to the presentation and discussion of papers and February 27 and 28 for the consideration of reports to be submitted by several committees. The business session of the association will be held on the afternoon of February 28 and the annual banquet on the evening of the 26th or 27th. It is proposed to show motion pictures pertaining to highways on two evenings during the congress.

Portland Cement in 1918

Statistics and estimates of the production of Portland cement in 1918 compiled under the direction of Ernest F. Burchard, of the United States Geological Survey, Department of the Interior, show a marked decrease in the total output; in fact, the output was the lowest since 1909.

The estimated shipments of Portland cement in 1918 amounted to 71,645,000 barrels, valued at \$113,910,000, compared with 90,703,474 barrels, valued at \$122,775,088 in 1917, a decrease in quantity of 21 per cent and in value of 7.2 per cent. The estimated production in 1918 was 71,632,000 barrels, compared with 92,814,202 barrels in 1917, a decrease of 22.8 per cent. The stocks at the mills increased from 10,462,882 barrels in 1917 to about 10,594,000 barrels in 1918, or 1.3 per cent.

The exports of hydraulic cement from the United States for the first 11 months of 1918 amounted to 2,025,178 barrels, valued at \$5,257,285, or \$2.59 per barrel. The exports for the whole year 1917 were 2,586,215 barrels, valued at \$5,328,536, or \$2.06 per barrel. The export trade also therefore fell short of that for 1917.

The decrease in output was the effect of the war restrictions imposed by the government upon fuel supplies, transportation facilities, labor, and private construction work in general, and the extent to which the cement industry in the several states and districts suffered is indicated in the accompanying tabular statements. Not a single state or district made an increase in the shipment or production of Portland cement in 1918; in many the decrease was near the average; in only a few was it less than 15 per cent or more than 30 per cent. Despite the universal decrease by states and districts an increase in output was made by individual companies in Colorado, Indiana, Iowa, Michigan, New Jersey, New York, Ohio, Oregon, Pennsylvania, Texas and Virginia, and many of the companies whose output decreased nevertheless regard the year's business as profitable on account of the higher prices they received for their product.

According to reports, two new plants produced Portland cement in 1918—the Old Mission, at San Juan de Baustista, Cal., and the Three Forks, at Hanover, Mont.—and six plants were idle during the year, one each in California, Kansas, Michigan, Nebraska, New Jersey, and New York. The total number of producing plants in 1918 was 114 and the total number of plants that shipped cement was 115.

The average factory price per barrel for Portland cement in bulk in 1918 ranged from \$1.34 in the Tennessee-Alabama-Georgia district to \$1.91 in California, compared with a range from \$1.22 in the Lehigh district to \$1.69 in Washington in 1917. The average price for the whole country was \$1.59 per barrel in 1918, compared with \$1.354 in 1917, an increase of 23.6 cents, or 17.4 per cent.

The wholesale market price of Portland cement per barrel at New York City during 1918 ranged from \$2.14 in January to \$2.90 in September, compared with a range from \$1.92 to \$2.12 per barrel in 1917, and with a practically stationary price of \$1.58 in 1913 and 1914, an increase during the period of the war of about 84 per cent.

Estimate of output of Portland cement in the United States in 1918, with actual figures for 1917, by districts:

District.	Barrels 1917.	Barrels 1918.	Percent- age of change in in 1918.	Average factory price per barrel in 1918.	Percent- age of change in price in 1918.
Lehigh district (eastern Pennsylvania, western New Jersey):					
Shipments	24,423,641	19,645,000	-19.6	\$1.532	+25.6
Production	24,423,507	19,679,000	-19.4	.....	.....
Stock	2,163,395	2,480,000	+14.6	.....	.....
New York State:					
Shipments	5,408,726	4,141,000	-23.4	1,616	+23.9
Production	5,417,530	4,150,000	-23.4	.....	.....
Stock	808,328	778,000	-3.8	.....	.....

Ohio and western Pennsylvania:					
Shipments	7,248,264	6,234,000	-14.0	1,500	+ 8.5
Production	7,345,416	6,481,000	-11.8	.....	.....
Stock	616,244	910,000	+47.7	.....	.....
Michigan and northeastern Indiana:					
Shipments	4,835,304	4,140,000	-14.4	1,655	+16.0
Production	5,263,810	4,371,000	-17.0	.....	.....
Stock	882,421	1,064,000	+20.6	.....	.....
Southern Indiana and Kentucky:					
Shipments	2,386,347	2,000,000	-16.2	1,598	+18.2
Production	2,517,257	1,639,000	-34.9	.....	.....
Stock	611,199	249,000	-59.3	.....	.....
Illinois and northwestern Indiana:					
Shipments	10,233,233	7,897,000	-22.8	1,466	+ 7.2
Production	10,927,990	7,156,000	-34.5	.....	.....
Stock	1,889,763	1,110,000	-41.3	.....	.....
Maryland, Virginia and West Virginia:					
Shipments	3,109,098	2,361,000	-24.1	1,629	+28.8
Production	3,122,936	2,313,000	-25.9	.....	.....
Stock	305,948	241,000	-21.2	.....	.....
Tennessee, Alabama and Georgia:					
Shipments	3,686,359	3,275,000	-11.2	1,337	+ 8.4
Production	3,676,354	2,992,000	-18.6	.....	.....
Stock	220,582	80,000	-63.7	.....	.....
Iowa, Missouri and Minnesota:					
Shipments	11,510,753	8,837,000	-23.2	1,646	+10.8
Production	11,774,381	9,561,000	-18.8	.....	.....
Stock	1,123,654	1,923,000	+71.1	.....	.....
Nebraska,* Kansas, Oklahoma, central Texas:					
Shipments	7,405,415	5,437,000	-26.6	1,649	+13.5
Production	7,710,365	5,316,000	-31.1	.....	.....
Stock	686,390	600,000	-12.6	.....	.....
Rocky Mountain States (Colorado, Utah, Montana and western Texas):					
Shipments	3,197,284	2,150,000	-32.8	1,818	+ 9.3
Production	3,261,675	2,242,000	-31.3	.....	.....
Stock	263,063	358,000	+36.1	.....	.....
Pacific Coast States (California, Washington, Oregon):					
Shipments	7,259,050	5,528,000	-23.8	1,899	+35.7
Production	7,372,981	5,732,000	-22.3	.....	.....
Stock	891,895	801,000	-10.2	.....	.....
Total: Shipments	90,703,474	71,645,000	-21.0	\$1,590	+17.4
Production	92,814,202	71,632,000	-22.8	.....	.....
Stock	10,462,882	10,594,000	+ 1.3	.....	.....

* No output in 1918.

Estimate of output of Portland cement in the United States in 1918, with actual figures for 1917, by States:

State.	Barrels 1917.	Barrels 1918.	Percent- age of change in in 1918.	Average factory price per barrel in 1918.	Percent- age of change in price in 1918.
California:					
Shipments	5,659,547	4,209,000	-25.6	\$1,906	+45.3
Production	5,653,362	4,432,000	-21.6	.....	.....
Stock	480,073	526,000	+ 9.6	.....	.....
Illinois:					
Shipments	4,378,233	3,696,000	-15.6	1,405	+ 1.0
Production	4,659,990	3,589,000	-23.0	.....	.....
Stock	805,763	671,000	-16.7	.....	.....
Indiana:					
Shipments	8,148,678	6,248,000	-23.3	1,544	+13.5
Production	8,705,831	5,323,000	-38.9	.....	.....
Stock	1,760,101	815,000	-53.7	.....	.....
Iowa:					
Shipments	4,428,765	3,203,000	-27.7	1,706	+10.0
Production	4,626,141	3,702,000	-20.0	.....	.....
Stock	618,811	1,095,000	+77.0	.....	.....
Kansas:					
Shipments	3,772,884	2,601,000	-31.1	1,595	+14.2
Production	4,015,169	2,520,000	-37.2	.....	.....
Stock	452,835	334,000	-26.2	.....	.....
Michigan:					
Shipments	4,313,771	3,577,000	-17.1	1,664	+17.3
Production	4,688,899	3,808,000	-18.8	.....	.....
Stock	713,796	904,000	+26.6	.....	.....
Missouri:					
Shipments	5,800,988	4,521,000	-22.1	1,603	+12.7
Production	5,882,240	4,750,000	-19.2	.....	.....
Stock	403,424	628,000	+55.7	.....	.....
New Jersey:					
Shipments	2,397,069	(*)	(*)	(*)	(*)
Production	2,449,876	(*)	(*)	.....	.....
Stock	237,554	(*)	(*)	.....	.....
New York:					
Shipments	5,408,726	4,141,000	-23.4	1,616	+23.9
Production	5,417,530	4,150,000	-23.4	.....	.....
Stock	808,328	778,000	-3.8	.....	.....
Ohio:					
Shipments	1,565,394	1,280,000	-18.2	1,504	+ 1.1
Production	1,566,209	1,469,000	-6.2	.....	.....
Stock	129,838	327,000	+151.9	.....	.....
Oklahoma:					
Shipments	1,736,761	1,278,000	-26.4	1,713	+13.0
Production	1,772,466	1,183,000	-33.3	.....	.....
Stock	70,708	44,000	-37.8	.....	.....
Pennsylvania:					
Shipments	27,709,442	22,557,000	-18.6	1,520	+22.0
Production	27,752,838	22,641,000	-18.4	.....	.....
Stock	2,412,247	2,795,000	+15.9	.....	.....
Texas:					
Shipments	2,358,944	1,926,000	-18.4	1,713	+10.4
Production	2,436,398	1,996,000	-18.1	.....	.....
Stock	222,537	272,000	+22.2	.....	.....

Utah:					
Shipments	899,599	503,000	— 44.1	1,577	— 3.0
Production	929,730	494,000	— 46.9	.....	.....
Stock	106,590	114,000	+ 7.0	.....	.....
Washington:					
Shipments	1,403,191	1,111,000	— 20.8	1,852	+ 9.8
Production	1,513,792	1,037,000	— 31.5	.....	.....
Stock	385,707	237,000	— 38.6	.....	.....
Other States:†					
Shipments	10,721,482	10,794,000	— 17.7	1,574	+ 17.0

Production	10,743,731	10,538,000	— 20.1	.....	.....
Stock	854,570	1,054,000	— 3.5	.....	.....
Total: Shipments	90,703,474	71,645,000	— 21.0	\$1,590	+ 17.4
Production	92,814,202	71,632,000	— 22.8	.....	.....
Stock	10,462,882	10,594,000	+ 1.3	.....	.....

* Included with "Other States."

† 1917: Alabama, Colorado, Georgia, Kentucky, Maryland, Minnesota, Montana, Nebraska, Oregon, Tennessee, Virginia and West Virginia. 1918: New Jersey included; Nebraska omitted.

Unit Built Concrete Snowsheds on Union Pacific Railroad

Many of the western and northwestern railroads are compelled to maintain snowsheds or snow fences along their lines to prevent delays and interruptions to traffic from heavy snowfall. In some cases these snowsheds amount, in effect, to aboveground tunnels and their location often compels heavy construction, because in addition to keeping snow off the track they must protect track from snow and landslides.

The usual conditions surrounding the construction of snowsheds are such as to make it quite improbable that the track will ever be moved to a new location, so the type of construction chosen should give due consideration to permanence. Almost universal practice in the past has been to use timber construction, principally perhaps because in snowshed country timber is the most available material. However, in a timbered country there is the ever-present danger of forest fires and it has not been uncommon for many miles of very expensive railroad snowsheds to be destroyed by fire. In October, 1915, 2,500 feet of snowsheds on the Southern Pacific Railroad at Summit, Cal., were so destroyed. Numerous other examples could be mentioned.

In 1910, the Great Northern Railway Co., built 3,900 lineal feet of double track snowsheds near Wellington, Wash., in the Cascade Mountains. Ever-present fire risk at this point and the desire to secure as nearly a permanent structure as possible influenced the Great Northern Company to adopt reinforced concrete construction.

This work was described in Engineering News of December 15, 1910. The sheds were designed to have



Interior View of Unit Built Concrete Snowshed.

great strength, and were anchored into the mountain sides so as to present a continuous path for the passage of snowslides.

In an attempt to secure greater economy in first cost, a combination type of reinforced concrete and wood snowshed was developed by the Great Northern in 1911. This type has back walls and foundations of concrete with timber posts and timber roof.

The most noteworthy example of concrete snowsheds was not long ago completed by the Union Pacific Railroad in Wyoming. These sheds are not required to withstand the force of avalanches; however, they are in open country where the snowfall is heavy and where, because of topography, drifts pile high

Unit construction was used. Various parts were pre-molded in a central manufacturing plant and shipped to the site of the work and erected with less relative difficulty than is frequently experienced with the usual shop-made parts of an ordinary steel frame structure. Footings of the pre-molded columns were built in place so that differences in elevation of the ground surface were overcome, making it easy to assemble the units. Practically no interference was caused to traffic during the work.

The structure is designed to withstand a moving load of 50 pounds per square foot of wind pressure on the side walls and 50 pounds of live load on the roof in addition to the dead weight. Details of connection between units are such as to afford adequate load carrying capacity and to promote easy and speedy erection.

Two general methods were used to erect these sheds: In one the equipment consisted of a special stiff-legged derrick mounted on rollers and carrying a 90-foot steel boom. The stiff leg was rolled along on blocking at one side of the track, and all units handled by the boom to their proper place on the side of or over the tracks. By the other method units were erected by locomotive cranes operating on a side track or on a special track over the ditches in cuts, always without interfering with the main track.

This entire work was carried on under the direction of W. R. Armstrong, Engineer Maintenance of Way, of the Union Pacific Railroad. Designs were in accordance with plans prepared under the direction of W. L. Brayton, bridge engineer of the Union Pacific, while construction was under the supervision of L. W. Alfall, Resident Engineer of the Houghton Construction Co., San Francisco, which had the contract.

Catalogues of Building Materials and Equipment for France

Richard L. Humphrey, Director of Building Materials, Building Materials Division, War Industries Board, writes as follows:

Mr. Paul Negrier, an engineer attached to the French High Commission, suggests the possibility of extending the knowledge of American building materials and thereby developing their use in France; with a view to furthering such purposes he will be glad to receive from the American firms, catalogues and price lists. His purpose is to classify such information and bring it to the attention of the French trade.

I will be glad if you will bring this matter to the attention of your readers with the suggestion that those who care to do so send such catalogue and price list to Paul Negrier, care Chas. Blanc & Company, 42 Boulevard Richard Le Noir, Paris.

This letter opens a field which some of our advertisers may wish to cultivate, and it is hoped they will promptly send to Paul Negrier full information concerning the materials they produce and their ability to serve such a French demand as may be created.

The Preparation of Sand and Gravel

By Raymond W. Dull

Sand and gravel or crushed rock plants just a few years ago consisted of a combination of individual ideas, local practice, market requirements, theories, some engineering, common sense and errors.

Local practice in many localities was satisfied with the use of the bank run or crusher varieties of concrete materials, with no particular care taken regarding percentages of voids, graduations or foreign matter. I would estimate that at the present time fully half of the gravel pits operating market their gravel just as it runs from the bank, all combined together from 1½-inch stone to ¼-inch pebbles, some of it washed, but without any regard to the amount of each size, just so it is gravel with the sand taken out.

We will endeavor to give our views regarding proper methods to use in the preparation of these rock products, with particular reference to washing and sizing.

It has been demonstrated that materials assembled together in such proportions as to form the densest mass make the cheapest and strongest concrete. This, then, calls for the producer to grade his gravel into several sizes. The materials can then be recombined to approximate the densest mass. Since the dollar and cents argument is usually the most impressive, we



Two Rows of Inclined Conical Screens, Showing Flumes to Sand Separators.



A Pumping Dredge. Discharge from Pump Is Into Dewatering Grizzly Feeding Direct Into Screens. Loading is into Scows Alongside.

wish to give Taylor and Thompson as an authority on mixtures with different percentages of voids, to show

the folly of using the 1½-inch to ¼-inch gravel as it comes from the bank or river, even if it is washed. Materials handled in this manner will vary from 30 per cent to 50 per cent of voids.

Assuming a mixture of 12½-5, an approximate delivered cost per barrel of cement of \$1.70, sand at \$1 and stone at \$1.70 per yard, the total cost for material to make one cubic yard of concrete with stone or gravel having 50 per cent voids is \$4.34; with 40 per cent voids, \$4.02, and with 30 per cent voids, \$3.68, a saving surely worth consideration.

Assuming then that it is desirable to grade the stone or gravel into several different sizes to recombine into the densest mass, we will discuss the best practice to make this separation. The general practice in coal screening and in fact all dry screening processes is to take out the fine materials first. This method retards the screening efficiency because the large pieces of material cover to a great degree the openings in the screen and hinder the smaller particles from passing through. With the use of water and individual screens it is possible to take out the largest particles first.

Greater screening efficiency is obtained in this manner because when the first separation is made we have the greatest quantity to screen and with the large size holes the material will more readily pass through the large holes than through the small holes and when we have screened down to the smaller sizes, which are more difficult to screen, we have to screen only a small percentage of the material we had at the start of the process.

We also find with this latter system that the finer screens, which are more delicate, are not subject to as much wear since they are relieved of the large stone.

By using individual screens for making each separate size, a trough or flume usually carries the material, which passes through each screen, by the aid of the washing water, into the following screen. The water is then used over and over again as each size of material is taken out, which utilizes the water to the fullest advantage.

The correct principle of washing materials is to agitate the material and water sufficiently to get all the mud and other impurities into suspension in the water. If any free mud is left and is not in suspension the washing has not been thoroughly done and the materials will not be clean.

A few years ago the writer was confronted with the problem of designing gravel washing equipment and undertook to develop machinery best suited for the purpose. Engineers had given the matter very little attention and the gravel pit owners were either compelled to develop their own machinery or to use equipment on the market very poorly adapted for the purpose. Shaker screens designed for coal screening or cylinder screens made for stone crushing were used principally.

Our final development of screens was the Inclined Conical Screens, all mounted on an inclined shaft. Our reason for designing the screens in this manner was to simplify the driving machinery for the individual screen arrangement. To install separate driving mechanism with the consequent wear was the first thing to avoid. The second condition was to

give the inclination of the screening surface the best working angle and the third condition to give the water pans for fluming from screen to screen the



Plant of the Akron Sand and Gravel Company, Akron, O., Showing Hopper, Crusher House and Conveyor (Goodrich Belt Used) Leading to Top of Plant. Crib Bins Are Reinforced with Railroad Iron.



A River Plant Complete Excavating with Clam-Shell Bucket Into Hopper, from Which the Material Is Carried by Elevators to Screens. Discharge is Into Scows Alongside.



Dredge Pump Mounted on Scow in Small Pond, Discharging Sand and Gravel Into Concrete Sump. Bucket Elevator Lifts Material to Screens Over the Bins.



A Cableway Excavator with 600-Foot Span. Bucket Is Digger, Elevator and Conveyor in One.

minimum possible slope and still carry the solids by the washing water. The last condition was necessary to keep the height of plant as low as possible and cheapen the cost of raising the material to the top of the plant.

Figure 1 shows the result. This set of screens has the simple drive. Only a pair of gears and a counter shaft constitute the drive connections for all the screens. The lower portion of the screens has the best screening inclination, which is $1\frac{1}{2}$ inches per foot. The water pans have a minimum slope of $2\frac{1}{2}$ inches per foot. So we have the three fundamental conditions all fulfilled in a remarkably simple manner. The bulk of the water is introduced at the large end of the first screen, which takes out the coarsest material, which passes out the small end of the screen.

The material which passes through the screen is carried by the water in the water-pan below the screen into the second screen when a second size somewhat smaller than the first size is taken out by the second screen in the same manner as the first size is obtained. This process is continued through the series of screen until all the gravel is removed. We now have remaining the muddy water and scoured sand which we will separate by the sand separator.

Scrubbing

Many materials do not always readily become clean without preliminary scrubbing. We found it advisable to devise something to agitate the materials and scour the stone to a considerable extent before going into the washing screens.

The scrubbers consist of a large cylinder mounted on the extension of the screen shaft axis and driven by the same gears. The cylinder is divided by internal rings, which retain the material and water in the compartments and the lifting vanes agitate and scour the mass similar to the action of a concrete mixer. The mass overflows from one compartment to the next and after passing through the four stages, the preliminary work is accomplished.

In addition to the water first introduced we range several jets, at the small ends of each screen, which flow in opposite directions to the travel of the material. These jets wash off the muddy water, sand and other particles which cling to the stone.

Sand Separators

We will now take up the separation of the sand from the muddy water. The most of the power-operated devices for this work which were in use for this work would not last very long. We made some extensive experiments to determine the best method of extraction of the sand. If the sand and water were run off together the water would soak through the sand and leave the mud in the sand similar to a filter bed. By inverting this method and drawing off the water at the top and with it the impurities held in suspension, and the sand below, we were able to obtain the desired results.

Our experiments determined that a conical shaped tank suspended on scale beam levers

was the most efficient device. The scale beam levers have knife edges and are almost as sensitive as any scale. The cone valve at the lower point of the tank is connected with the counter-weight lever and an upward motion of the counter-weight lowers the cone valve. If, then, sufficient sand accumulates or settles in the tank to cause the counter-weight to rise, the cone valve drops and a sufficient amount of sand escapes from the tank to the bins below until the tank is relieved of the excess weight and the valve is automatically closed. The discharge is intermittent and there is a sufficient quantity of sand in the tank at all times to make a sand seal to prevent the water from going through with the sand.

Bin Construction

In some of the earlier plants which we designed we used the cribbed construction. We found that the life of the bins was short because the water would be held in the cracks between the planks and the wood would decay rapidly.

We then adopted a construction which did not have this fault, was more accessible for the replacement of timbers and provided means to perpetuate the life of the bins.

You will note that vertical studding is used with planking spiked on the inside and whallens on the outside of the studding to reinforce them. Heavy steel tie rods with large washers run through the whallens from wall to wall, take care of the side pressures of the bin walls. The spacing of the studding and whallens are closer together at the bottom of the bin and further apart near the top, where the pressure is not so great and in this way a minimum amount of lumber is used for the bin.

You will also note that no floors are used in the bins. The material is put in the various bins and only the material above the flow angle of the gates is drawn off. The material below the gates forms the floor with the hopper effect leading to each gate. The bed of material also forms means for the escape of the water clinging to the material after washing and the material is loaded into the cars in a dryer state.

A few bins are made of reinforced concrete, but this is not a very general practice. The reason is the increased cost and no great necessity for permanence.

We have also installed plants with circular steel tanks, but not since the price of steel has advanced to make this construction prohibitive.

Methods Used for Excavating Materials

Quite a variety of methods are used for excavating the material. One reason is that pit owners are often contractors who have purchased steam shovels or locomotive cranes and wish to use them rather than buy special equipment. The physical condition also is a great deciding factor on the best method for excavating and another deciding factor is the capacity of the plant.

In some localities the material is taken from a river and calls for a cableway of 1,000 or even 1,500 foot span. Some of these cableways have traveling towers and others pivot about one tower and have the other tower mounted on circular tracks. River work is more or less hazardous due to floods, and unless a floating plant is installed the cableway system is used with towers which are placed on opposite banks.

Another system of excavation which has become very popular where local conditions will permit, is the slack line cableway excavator. These systems will operate very efficiently over a span of 500 feet, but we do not recommend them for a greater span. This system operates much faster than the other style of cable way.

This style of excavator is installed with a main tower or mast at one end and an anchorage of some sort at the ground level at the other end. The bucket is suspended from a trolley which runs on the main track line. The machine is operated by a two drum hoist. The main cable is raised and lowered by means of a block and fall arrangement, the cable from which leads to one of the drums of the hoist. Another cable called the load or drag line is attached to the bucket and leads to the other drum on the hoist.

In operation the bucket runs down the inclined main track line by releasing the clutch on the drum and controlling the drum by the brake. The descent of the bucket is very rapid, and it only requires about ten seconds to travel the 500 feet. When the bucket reaches the digging point the main track line is lowered until the bucket rests on the material. The bucket is loaded by pulling forward and when full the main track line is raised and the bucket brought to the dumping point.

A few cars are designed to take the cars which bring the material from the steam shovel up an inclined trestle by means of a hoist. This method is satisfactory for small plants, but is hardly as efficient as the belt conveyors on larger plants.

Belt Conveyor Systems

The usual arrangement for belt conveyors is from a track hopper into which cars dump and from the hopper the material is fed to the belt conveyor which carries it to the top of the plant.

The commercial cast iron idler is not very strong and we have developed an idler with a pressed steel pulley for this work.

Field Conveyors

Another method used for bringing the material from the excavator to the plant is the field conveyor. The way we advocate constructing them is to build the conveyor on a series of sleds. Each sled can then be lined up independently. The advantage of this system is that a continuous flow of material goes to the plant. Better screening results on account of this steady flow through the screens.

Power Used

Most of the plants are electrically operated with small groups of driving connections for the smaller machines and individual drives for the larger units. Steam driven plants are also extensively used and a few use oil engines.

The oil engine plants which are near the source of oil supply are able to furnish power cheaper than any other kind of power.

Floating Plants

In dredging from the river many plants are constructed on boats. A complete washing plant for washing and grading and making a finished product delivers to several scows alongside the boat. Each scow receives a different grade and the waste material is run back into the river or lake.

These plants must also be designed to suit many different conditions. In some cases dredge pumps are used and where the material is too hard for pumping orange peel buckets are used. Dredging elevators are also used for this purpose.

Dredge Operation Delivering to Land Plant

This style of plant, where a portion of the material to be excavated is below water level and is not packed too tight, gives very efficient results. Many installations have gone wrong because they have attempted to pump to the top of the plant, which resulted in excessive power requirements and numerous mechanical and screening difficulties. We recommend pumping to

the plant with the pipe line as near horizontal as possible. The material can be dewatered in a concrete sump or basin and the material elevated to the top of the plant by a dredging elevator. Take as an example, a dredge pump usually delivers 10 per cent solids, and to raise ten tons of water to get one ton of material is not a very efficient process.

The dredging elevator is fitted with manganese and chrome nickel wearing parts and dredges out the bottom of the sump in a continuous operation without much attention.

The Gravel and Crushed Stone Producers' Chance

The road building movement in the United States is assuming tremendous proportions. The importance of better highways was emphasized during the late war by the annoying freight congestion, bringing into service as it did thousands of motor trucks which attempted to make up for the inability of railroads to transport the immense freight and express offerings brought about primarily by the abnormal movement of goods to the Atlantic Seaboard.

Our highways had not been constructed to withstand the heavy traffic thus imposed upon them and, as naturally might have been expected, broke down under the strain. As a railroad engineer would express it, they were not sufficiently ballasted. They were too lightly built.

Briefly, the answer to the problem is more gravel and crushed stone. That is where the quarryman and gravel producer comes in strongly.

When our army engineers who have seen service in France return to this country, they will not be satisfied with the lightly ballasted American roads. They know from their experience in Europe the desirability, nay the necessity, of good foundations, thick and well bound surfaces. They will undoubtedly introduce into this country the military ideas as to what constitutes good road construction.

There are hardly a score of roads in the United States built to withstand heavy traffic. The time is ripe for improving the roads of the United States. Everything favors the movement. The realization of the necessity for better roads, the availability of labor to do the work, the quarries prepared to furnish the stone because of the small amount of other building in prospect and the pressing demands of the farmers for better highways all point to the fact that now is the time to start improving the country's highways.

The farmer has long realized that good roads mean increased trade between the farm and city homes, higher profit to the farmer by cutting out the middleman, farm to home sales for eggs, poultry, pork products, vegetables and all farm produce.

It is the desire of the government as well as of the business interests of the country to create work for the thousands of returning soldiers and the even greater thousands of ex-munition workers released by the discontinuance of war activities.

The crushed stone and gravel producer should take advantage of this opportunity to sell an unprecedented output of stone. Ordinary building activities probably may not call for a large amount of stone until materials and labor markets reach what are generally considered to be normal levels but this condition, we anticipate, will not affect nor curtail road building activities.

The gravel and crushed stone producers' one best bet, therefore, is road building. They do not have to create the interest nor initiate the movement. Indus-

trial and political conditions have attended to all of that for them. Nevertheless, they should get behind the movement and push. They should, by every means in their power, increase the interest in good roads movements in their part of the country. Getting the people, especially the farmers, the business men and all others who would be benefited by better highways, to talking about and agitating for increased road production and better roads will actuate those having the initiation of municipal, county and state appropriations to take the proper action.

All this is going to help create a demand for crushed stone, sand, gravel, lime, cement, asphalt, tar and other road making materials. In fact, 1919 ought to be the harvest for manufacturers of road machinery and producers of road materials. However, the good business man does not wait for the harvest apple to drop into his lap. He climbs the tree and picks it. Applied in a practical way, that means that if the road building movement materializes to the advantage of the road materials men, it will be partially at least because he does everything in his power to develop it.

Michigan Sand and Gravel Products

The first annual meeting of the Michigan Sand & Gravel Producers Association held at Hotel Pontchartrain, Detroit, January 23rd, was a splendid success; of the twenty concerns who are members there were fourteen represented, by fifteen gentlemen.

Many matters were discussed and harmonized. Mr. H. S. Earle gave a very interesting talk as usual and Mr. Guy C. Baker made a splendid statement of the freight rate matter and its present condition and what he had done in connection with it during the past few weeks.

Two new members were added, the Burwell Gravel Co. of Lansing, and the Detroit Ballast & Gravel Co. of Armada.

Committees of three members were named by the president as follows:

Legislation—W. H. Alswede, of the Hersey Gravel Co., Hersey; N. H. Battjes, of the Standard Builders Supply Co., Grand Rapids; W. F. Fisher, of the Tecumseh Gravel Co. of Tecumseh.

Freight Rates—W. F. Bradley, of the Ohio & Michigan Sand & Gravel Co., Toledo; Guy C. Baker, of the Detroit-Greenville Gravel Co., Brighton; H. S. Earle, of the Genesee Gravel Co., Detroit.

Machinery—G. A. Seviour, of the United Fuel & Supply Co., Detroit; W. O. Smith, of the Detroit-Oxford Stone & Gravel Co., Oxford; John S. Porter, of the Huron Shore Gravel Co., Saginaw.

The old officers were re-elected and the executive committee is the president, the secretary-treasurer, G. A. Glarum, Guy C. Baker, H. P. Belknap, W. F. Bradley and N. H. Battjes.

Sentiment was pronounced that the association should meet oftener and there will likely be a meeting during the latter part of March.

Highway Work in Delaware

Mr. Shertzer of Lime Association recently spent a day with Chas. U. Upham, chief engineer, State Highway Department of Delaware. Most of the time was spent on the site of construction of a new 9-mile section of concrete road in which 10% of hydrated lime (by volume of cement) was being used. Many interesting phases of road construction were gone into thoroughly and it was finally decided by Mr. Upham, after various experiments during the day, to increase the quantity of hydratee slightly to 15%, as this amount showed an improvement in workability over the 10%.

Electric Motors in the Cement Industry

By R. B. Williamson

ABSTRACT OF PAPER

This paper has been compiled by the Committee on Industrial and Domestic Power of the American Institute of Electrical Engineers to give general information regarding the different classes of machinery used in the cement industry and the sizes and types of motor best adapted for the work. The paper gives, first, a brief description of the process. This is followed by an outline of the various kinds of machinery used together with data as to power requirements. The types of motor best suited to each application together with starting characteristics, overload capacity, torque and other features are indicated.

Practically all modern mills manufacturing Portland cement are driven by electric motors, and since the process is mainly one of crushing and grinding, a large amount of power is required.

Before considering the various motor applications, it may be advisable to give a brief outline of the process of manufacturing Portland cement, which constitutes about 99 per cent of the cement of all kinds manufactured in the United States.

General Description of Process

Portland cement is generally formed by an artificial combination of calcareous and argillaceous materials. These materials are mixed either before grinding or during the process of grinding. After being ground so that from 80 to 90 per cent of the material will pass through a screen having 200 meshes per lineal inch, it is burned to incipient fusion in a rotary kiln, after which the resulting clinker is again ground so that at least 78 per cent will pass the 200-mesh screen.

The Portland cement clinker, after it leaves the rotary kiln, requires no further treatment than grinding, excepting the addition of about 2 per cent of gypsum to retard the setting. In some parts of the United States natural cement rocks are found which contain nearly the proper proportions of materials to produce Portland cement; but, even in these localities it is generally necessary to add either limestone or shale in order to get the proper mixture. Certain deposits of argillaceous material. Blast furnace slag, like cements of materials, that at one time limestone must be added and at another time shale.

In the United States, limestone furnishes the largest supply of calcareous material for Portland cement. Other sources of supply for this class of material, in addition to cement rock mentioned above, are marl, chalk and alkali waste. Shale and clay are most commonly used for obtaining the argillaceous material for Portland cement. Cement rock mentioned above, as well as blast furnace slag, are also used as a source of argillaceous material. Blast furnace slag, like cement rock, contains a considerable proportion of lime and has the further advantage that this lime is found as calcium oxide instead of the carbonate; therefore, the heat necessary to dissociate the carbon dioxide gas from this part of the lime is not required.

The preliminary crushing of limestone, cement rocks and shale is ordinarily done in the crushers of the gyratory, jaw or roll type. Materials may be ground either in the wet or dry state. Fig. 1 shows a typical flow sheet for a wet mill and Fig. 2 for a dry grinding mill. In a dry grinding plant, the two classes of materials are preferably dried separately and then weighed, after which they are ground. In a wet grinding plant, the materials are generally measured or weighed in their natural state as excavated, and then ground. Where shale or cement rock is used as the argillaceous material, it must be crushed in rock crushers. In the past, it has been the practice in certain wet grinding cement plants to dry the clay in

order better to store and handle it, and also to eliminate gravel and other foreign material. The better practice, however, is to dump the clay in its natural state into a wash mill where sufficient water is mixed with it to allow the heavy pieces of gravel to settle out, and also to form a slurry which can easily be stored in tanks. The flow sheet, Fig. 1, for a wet grinding

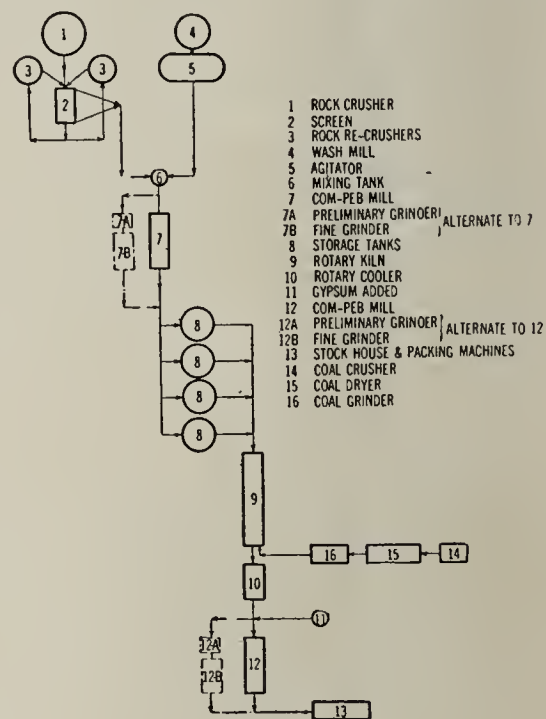


FIG. 1

cement plant shows a wash mill installed for handling the argillaceous material. Wash mills are used only for clays, marls and similar materials, which, by mixing with water, can be kept in suspension. If shale were used as argillaceous material, a crusher of some type would have to be provided instead of a wash mill.

The same general type of grinding machinery can be used for either wet or dry grinding. In the past, it has been customary to use a preliminary and a finishing grinder; but, the latest development in cement practice is to use a combination mill which combines the preliminary and finishing grinder in one machine, eliminating considerable expense in cost of installation and reducing materially the cost of operation. The combination mill has its greatest advantage in eliminating one set of storage bins and a great deal of elevating and conveying machinery. Combination mills consisting of a preliminary compartment charged with steel grinding balls and a finishing compartment charged with flint pebbles were tried many years ago, but mills of this type have never been successful until the introduction of the iron grinding body in the finishing compartment. The introduction of iron grinding bodies in the finishing compartment has also increased the capacity of mills of a given size, resulting in greatly simplifying the design of a cement

plant, also reducing the cost of installation and operation.

While most mills have in the past been arranged for dry grinding, there is a strong trend towards wet grinding in new installations. The principal advantages of the wet process are, cleanliness, less tendency for different materials to segregate, and better opportunity to correct the mixture to obtain the exact proportions desired.

In the early days of the manufacture of Portland cement, the ground raw material was made into bri-

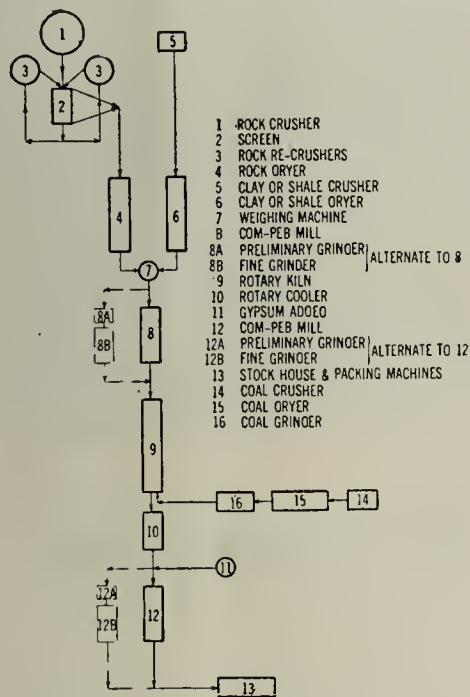


FIG. 2

quettes and then charged into a vertical kiln and burned. This process of burning was more economical in fuel consumption than rotary kilns, except of the very latest type, but had the disadvantage that a great deal of the material was wasted on account of being improperly burned and the labor cost was very high. In the United States, fuel was comparatively cheap and the cost of labor high, and, as might be expected, the rotary kiln is an American invention. The improvements made in the rotary kiln have resulted in such saving in the cost of burning cement that it is now generally used throughout the world.

The clinker leaves the rotary kiln at a high temperature, and before grinding it must first be cooled. Most modern cement plants use a rotary cooler after the kiln. The cooler is preferably placed below the kiln in order to conserve the sensible heat of the clinker, the air for cooling the clinker passing up into the kiln to support combustion. In addition, however, to cooling the clinker, it is desirable to age it before grinding, as aging not only improves the quality of the cement, but also increases the "grindability" of the clinker. The aging of cement can either take place before grinding or after grinding; but, the cement can be more cheaply stored in the condition of unground clinker than after it is ground.

The grinding of the clinker into finished cement requires more power than any other step in the process, as the clinker ordinarily is much harder to grind than the raw materials. It is common practice in American cement plants to grind the raw material and the clinker to about the same fineness. There is at the present time, a tendency to demand more finely ground cement, specifications for Portland cement in the United States having been changed in 1916 from 75

per cent through 200 mesh to 78 per cent through 200 mesh. There is a greater tendency, however, to grind the raw material extremely fine. There are three advantages in the extremely fine grinding of raw material; fuel is saved, a better cement is produced, and the clinker from finely ground raw material is more easily ground than clinker from the same material not so finely ground.

Natural gas and fuel oil are used in a few cement plants, but the most commonly used for burning Portland cement is finely pulverized bituminous coal. Bituminous coal is crushed in a preliminary crusher, or the screenings from the coarse coal are used, after which it is passed through a rotary dryer and then ground so that about 85 per cent passes through a 200 mesh sieve. Finely pulverized coal is blown into the rotary kiln by an air blast; the pressure used varies greatly but is generally from two to six ounces.

General Conditions Affecting Motors

The same reasons that hold for the preference of a-c. to d-c. motors in general industrial work make the a-c. motor more desirable for cement mill operation. There are two main reasons for this. First, the relatively higher alternating voltage that can be used, i. e. 440 or 550 volts or even 2200 volts for some of the motors in large mills; and second, the greater mechanical simplicity of the a-c. motor, particularly that of the squirrel cage type. The great majority of cement plants use alternating current, though there are a number of mills equipped with d-c. motors which have given excellent service. There is nothing inherently injurious about the action of cement dust on the commutators of d-c. machines, and they are successfully employed in some plants, but, all in all, the a-c. motor is preferred and used. The following features should be borne in mind in selecting motors for a cement mill.

Service. Continuous. Shut down for repairs only.

Starting Conditions. Severe on many applications and making phase-wound-rotor motors preferable or even essential.

Rating. May be affected by heavy accumulations of dust on the motor windings, thus interfering with ventilation. Machines should be frequently blown out and cleaned off.

Bearings. Should also be made dust proof by the use of felt and steel washers, as cement has a highly abrasive action and greatly increases bearing wear when present in the bearings.

Outboard Bearings. It is a good practice to supply outboard bearings for belted motors of 75 h. p. and larger. Pulleys larger than usual in both diameter and length are often specified since the cement dust causes more than normal belt slippage and makes necessary tighter belts and increased strain on bearings.

Drive. Motors should not be direct geared to crushing machinery on account of excessive and severe vibration. Low speed motors direct-connected through flexible couplings, or belted, are the proper application. So far as possible, motors and belts should be placed in a separate room for protection from dust and to prevent their agitating the dust in the room where the mills are located.

Type of Motors. Alternating-current preferred, squirrel-cage where starting conditions are fairly easy, and wound rotor motors where starting is severe. Low or moderate-speed motors should be used. On account of the unfavorable belt conditions large speed

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SUPPOSE every man, woman and child in Sharon, Pa., for example, suddenly stopped their everyday occupation and started making rubber goods.

With a grinding of brakes and a hissing of compressed air every bit of industrial activity in that flourishing town would come to silence. Factories close—street cars halt—newsboys hush their strident cries—business offices pull down the blinds—and women turn from oven and tea-table—

And all start making, tires, boots, water bottles, hose, surgical goods and those thousand and one blessings that the Creator made possible when he put that strange white liquid just under the bark of a little tree down in South America.

The Goodrich Factories at Akron—one gigantic single group of sixty-three buildings—constitute a force far beyond that represented by the busy little city we have just used as an example.

It is literally a city—with its own postoffice, restaurants, and physicians; and it has police and fire protection and free schools just like any other town its size.

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etc.

MECHANICAL RUBBER GOODS

reduction ratios should be avoided. Moreover, low- or moderate-speed motors are more substantial mechanically than high-speed and give less bearing trouble.

Collector rings are not injured by cement dust, which, when dry, does not show the abrasive action that it does in the bearings. It is advisable, however, to protect collectors so that dust cannot settle on them in large quantities.

While the induction motor has been used almost exclusively for cement plant operation, there are indications that synchronous motors will be adapted to this work more in the future. This is specially so in the case of low-speed motors for geared tube mills as mentioned later.

Frequency. Frequencies of 60 cycles and 25 cycles are in common use. Most of the large plants that are operated in connection with steel mills have 25-cycle equipment since they usually get their power from the same source as the steel mill, and 25 cycles has been generally used for steel mill operation. A few plants are in operation at frequencies other than 25 or 60 cycles but these are on the whole exceptional.

Voltage. 440 volts preferred to 220 on account of copper distribution; 550 volts is satisfactory in a dry process plant. In some large mills 2200 volts has been used for the large motors but this practice is not common.

Load Factor. May be as high as 95 per cent since the machines run at all times under constant full load. The load factor of the average complete cement plant runs from 65 to 75 per cent taken through the entire year and is probably the highest of any industry.

The various kinds of machines that may be employed for the different processes in a cement mill may be grouped as follows:

1. Elevator and conveying machinery for raw material.
2. Crushers.
Gyratory Jaw Roll.
3. Intermediate crushers.
Roll Hammer mills.
4. Rotary Dryers.
5. Preliminary Grinding Machinery.
Ball mills Rolls
Ring-roll mills Huntington mills
Hammer mills Griffin mills.
Fuller mills
Raymond mills.
6. Finish Grinding Machinery.
Tube mills
Combination mills.
7. Conveying Machinery for Finished Product.
8. Rotary kilns. Coal feeding machinery.
9. Cement Grinding machinery.
(a) Preliminary grinding
Ball mills
Rolls
Griffin mills
Ring roll mills.
(b) Finish grinding
Tube mills
Ball peb mills
Combination mills.
10. Coal Grinding and Drying Machinery. Same class of machinery as used for raw material.

Elevators and Conveyors

Every cement plant requires a large number of elevators, and conveyors for handling the material between the various steps in the process. One modern 3000-barrel plant, as an example, has 14 elevators, 2 belt conveyors and 8 screw conveyors in its equipment. It is very important that these auxiliaries be kept operating, as an accident to a conveyor or elevator may shut down an entire department of the plant until repairs can be made.

Various methods of driving this class of machinery have been installed in different mills. The chief difficulties are that the driving shafts run at extremely low speeds and that elevators must be driven from the top. The first necessitates a number of countershafts and belts or gears to give the necessary speed reduction and the second means that the driving motor, if individual drive is used, must often be located in an inaccessible place and in many cases subjected to considerable vibration due to weak foundations. A very good method of drive which is sometimes applicable, especially in case of crushers or group drive of grinding machinery, is to belt the elevators and conveyors from a pulley on some part of the mill shafting or from a small pulley on the front end of the motor.

Another method adopted in some plants is to group several elevators and conveyors on one motor, driving through countershafts and belts or chains.

The third possibility is to put an individual motor on each conveyor and elevator. In applying individual motors to this class of work, however, there are certain points which should be borne in mind if trouble is to be avoided. The machinery is rather roughly built, especially bucket elevators and bucket and drag type conveyors. These usually consist of two parallel chains driven by rough cast or forged sprockets, and carrying the buckets between them. It sometimes happens that the chains will climb up on the teeth of the sprockets and throw heavy overload on the driving motor which may be enough to stall it. Screw conveyors occasionally wear their bearings down so far that the screw may rub against the trough for most of its length with subsequent overload. These possibilities make it advisable, in the case of individual drive, always to install motors from 25 to 50 per cent larger than necessary to meet the average power demand. This is not true when group drive is used and it is very unlikely that more than one unit of the group would be subjected to overload at the same time and this would probably not affect the operation of the motor to any great extent. At the same time, group drive has the disadvantage of requiring more belts and countershafts and of the probability of crippling an entire department if an accident happens to any unit or any part of the transmission.

The lengths and types of elevators and conveyors differ so much with different plants that it is impossible to give a table which will be of much assistance in estimating the power required, but the following test results will probably be of some service in such work.

Screw conveyor on dry clay.

Diameter	16 in.
Pitch	16 in.
Length	120 ft.
Sped of screw.....	65 rev. per min.
Horse power	5.5

Screw conveyer on pulverized coal.	
Diameter	16 in.
Pitch	16 in.
Length	162 ft.
Sped of screw.....	55 rev. per min.
Horse power	3.7
Belt conveyer on finished cement.	
Width	20 in.
Length .....between centers	230 ft.
Height material is lifted.....	40 ft.
Speed	200 ft. per min.
Horse power	10-14
Belt conveyer on crushed stone.	
Width	20 in.
Length .....between centers	135 ft.
Height material is lifted.....	22 ft.
Speed	211 ft. per min.
Horse power about.....	5
Elevator on crushed stone.	
Buckets	18x10x16 in.
Height material is elevated....	52 ft.
Speed	83 ft. per min.
Horse power	3 to 5.5 ft.
Elevator same as preceding except elevating to 60 feet instead of 52 feet. Horse power 2 to 3 (probably due to better lubrication.)	
Elevator on crushed stone.	
Buckets	48x8x12 in.
Height material is raised.....	62 ft.
Speed	95 ft. per min.
Horse power..8 to 10 (occasional peaks above 15)	

The starting torque of elevators and conveyers is likely to be above normal running torque, but standard squirrel-cage motors, if large enough to take care of the peak loads as mentioned above, should have no difficulty in starting them.

Crushers

All dry process cement mills require extensive crushing plants for their limestone cement rock. Three types of crusher are in common use for this work. Gyratory crushers are used more than any other, although those of the jaw type, or crushing roll, are preferred in some cases.

Gyratory Crusher. The gyratory crusher has a vertical shaft with a bearing at the top and bottom. The shaft is driven by a bevel gear and pinion at the lower end. The shaft is eccentric with respect to the bottom gear and journal so that the shaft gyrates as the gear revolves, the amount of side movement being a maximum at the bottom and a minimum at the top. Attached to this shaft is a conical crushing head of chilled iron or special steel, sometimes smooth and sometimes corrugated. The shell or mouth of the crusher surrounds the crushing head and is lined with special iron or steel plates. The shell is conical but inverted so that the distance between its surface and the crushing head is a maximum at the top and a minimum at the bottom. As the shaft rotates, its gyratory motion causes the head to alternately approach and recede from the shell so that the large pieces of rock which are fed in at the top are gradually broken up and fall lower and lower in the shell until the pieces are small enough to fall out through the space between the bottom of the head and shell on to a sloping diaphragm between the bottom of the shell and the driving gear, which directs the crushed pieces into the discharge spout.

In all cement plant crushing, the problem is to reduce the rock from the size as it comes from the quarry down to a size small enough to pass an inch or a $\frac{3}{4}$ -inch ring. It has been found that it is better to divide this range into two steps instead of making the entire reduction in one machine. Therefore, in most crushing plants, the

rock first passes through a large crusher which reduces it to three- or four-inch cubes, after which it is reduced to the required size (usually $\frac{3}{4}$ to 1 inch) in smaller crushers. Occasionally, revolving screens are installed to grade the material as it comes from the crusher, all that which will not pass through the screen being returned for further reduction.

There is a considerable difference of opinion regarding the size of the first crusher. The rock as it comes from the quarry is made up of pieces of various sizes ranging from small chips up to pieces three or four feet in diameter, the only limit being what can be handled by a steam shovel. The great majority of the pieces, however, are under 20 inches. Some cement manufacturers install for the first crusher a machine large enough to take the largest pieces, while others use a crusher large enough for the average size and break up the extremely large pieces with dynamite before taking them to the crusher house. The advantage of the first method is that it eliminates this dynamiting, thus saving labor and expense in the quarry. Its disadvantage is that a crusher large enough to take care of the few exceptionally large pieces will probably have a much greater capacity than necessary so that it will be idle a great deal of the time, and will represent considerably more investment than a smaller machine, as well as a greater consumption of power.

The size of the crushers is designated by an arbitrary number. Practically the same system is used by the different manufacturers, so that a No. 8 crusher, for instance, is about the same size capacity, etc., whether one make or another. Table 1 is therefore approximately correct for all makes. As a No. 3 crusher is the smallest which is likely to be used in any cement plant, data are omitted on number 0, 1 and 2.

Table 1

Power Requirements of Gyratory Crushers

Makers No.	Size of opening on each side of top bearing arms	Size cube which can be crushed	Horse power
3	7x28	7	10- 20
4	8x34	8	15- 25
5	10x40	10	20- 35
6	12x44	12	25- 40
7- $\frac{1}{2}$	15x55	15	50- 70
8	18x68	18	65-100
9	21x76	21	100-140
10	24x99	24	125-175
18		36	150-200
21		42	150-200
24		48	175-225
27		54	200-250

The horse power figures given in Table 1 must be used with discretion because there are a number of factors which affect the power required by crushers. Chief among these are the hardness of the material to be crushed and the method of feeding. On soft rock or shale the power will be lower than when crushing very hard stone, the difference being about as indicated by the two limiting powers in the above table. When crushers are fed intermittently as for example the very large crushers which take the material when it first comes from the quarry and which are of such great capacity that they can run a small carload of rock through in less than a minute, after which they may run light for several minutes, the driving motor can be somewhat smaller than for crushers of the same size fed from bins where the power is more nearly continuous. It is the usual experience that crushers are "over motored," and the horse power data given in the above table are more likely to be high than low.

Belt drive is used almost exclusively, an incidental ad-

vantage being that the belts afford some protection against damage in case pieces of iron, etc., get into the rock accidentally. Installations seem to be about evenly divided between those using individual motors and those in which the entire crushing plant including possibly three or four crushers with their elevators and conveyers are driven in a group from one large motor.

The starting torque required by a gyratory crusher is small unless it is accidentally stopped with material in it,

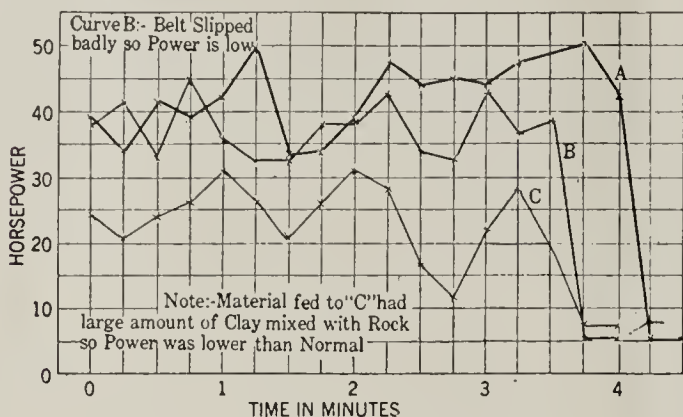


Fig. 3—Tests on Three No. 5 Crushers—Each Driven by 25-horsepower, 600 Revolutions Per Minute.

- A. Crusher with Corrugated Head—1½ in. Product.
B. Crusher with Corrugated Head—1¼ in. Product.
C. Crusher with Smooth Head—1 in. Product.

in which case it is usually necessary to dig it out before it can be started.

Typical load curves on crushers are shown in Figs. 3 and 4. The former illustrates the difference that may exist between the power required by crushers of the same size due to the quality of the material.

Jaw Crushers

In jaw crushers of the Blake type the crushing takes place between the two jaws set at an acute vertical angle, one fixed and one movable; the feed opening at the top being greater than the discharge at the bottom, gravity brings the material into the crushing zone and discharges it when crushed. The movable jaw is suspended from the top of the crusher frame and is given a reciprocating motion by means of an eccentrically operated vertical pitman and a pair of toggle plates.

The most favorable condition for jaw crushers is obtained when the ratio of size of feed to product does not exceed 6 to 1. When this ratio is exceeded, the efficiency of the crusher is greatly decreased, and an increase in the power requirement will be noted. With the ratio of 6 to 1, the power requirement remains practically constant whether the reduction is from 18 in. to 3 in., or from 6 in. to 1 in. The amount of material crushed, however, will be in proportion to the width of the discharge opening, *i. e.*, when reducing from 18 in. to 3 in., the crusher will handle approximately three times as much material as when reducing from 6 in. to 1 in., all other things such as size of feed openings, speed, etc., remaining constant. Any increase or decrease within

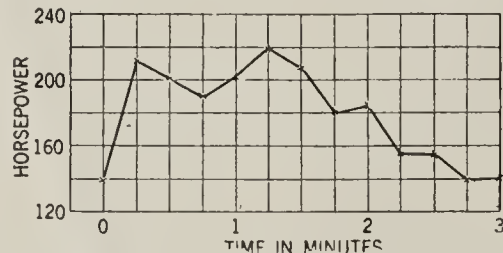


Fig. 4—Power Required to Drive Mammoth Crushers While Crushing One Carload of Rock—Feed Average Size from Quarry—Reduces to 4 in.—5 in. Size.

certain limits in the speed of the crusher will increase or decrease the volume of material handled and the power required.

The power required to operate any given size jaw

crusher, depends on the power required to operate the crusher when running idle and the power required to do the work of crushing the material.

Consider these in the order as given above: The power required to operate a crusher when it is running idle is due principally to friction, and this will vary considerably for different sizes, speeds and makes of machines. When figuring the power requirements of a jaw crusher, it would be preferable to obtain the friction of the crusher direct from the manufacturer.

For the Blake crusher, there is one theoretically correct speed based on the law of gravity. The time period of the stroke of the movable jaw must not exceed the rate of movement of the material due to gravity. Therefore, there is one theoretical speed for all sizes of crushers, but it is obvious that there is a mechanical limitation when a certain size of crusher is reached that will necessitate the use of a lower speed.

An approximation of the power required to operate the crusher when it is doing no work is

$$p_m = 0.016 \times b \times w$$

where

p_m = horse power

b = breadth of opening of jaws in inches.

See Fig. 5.

w = width of opening of jaws in inches.

See Fig. 5.

Power required to crush the material.

The amount of material M passed by the crusher is*

$$M = \frac{sb(2d+s)R}{57.6 \tan. \phi}$$

Where M = cubic feet of material per hour.

s = stroke in inches measured at the throat of crusher. See Fig. 5.

d = average distance in inches between the fixed and movable jaws and the minimum and maximum position of the swing jaw as measured at the throat of the crusher. See Fig. 5.

b = breadth in inches at opening of jaws. See Fig. 5.

R = Revolutions per minute.

The angle ϕ varies for different makes of crushers from 20 deg. to 26 deg.

*Wiard, "Theory and Practise of Ore Dressing."

The above formula gives the theoretical capacity and is the one used in figuring the power requirements. In order to obtain the actual capacity, the theoretical capacity should be divided by 1.6. This is on account of irregularity in feed, hardness of material, size of material, etc.

In the smaller sizes of crushers, where the breadth b is small and the stroke s is large, comparatively, it is found that the theoretical capacity M is as much as 3¼ times the actual capacity. This is due to the fact that these smaller sizes of crushers are very inefficient when compared to the larger sizes; this is found for example to be the case of the 10 in. x 7 in. machine as shown in Table 2: Therefore, the empirical formulas as herein given will not apply to these small crushers.

Power required to crush the material (dry limestone).

$$p_c = p M$$

where p_c = horsepower.

p = take from curve—Fig. 6.

It is assumed that the size of the product will never be less than one inch and that the reduction will never be more than 6 to 1.

The total power required to operate the crusher when doing work

$$P = p_m + p_c$$

Where P = horse power.

The above formulas have reference only to the crushing of dry limestone.

[To Be Continued]

New Lime, Potash and Agricultural Pulverized Limestone Works of the Clinchfield Cement Corporation

By Chas. R. Wright

The latest cement manufacturer to engage in the manufacture of lime, potash and agricultural pulverized limestone is the Clinchfield Portland Cement Corporation, Kingsport, Tenn., who have had in operation since 1911 one of the most modern cement plants in the country, producing now 3,600 barrels of cement daily, which has earned an enviable reputation for high quality and uniformity throughout the South.

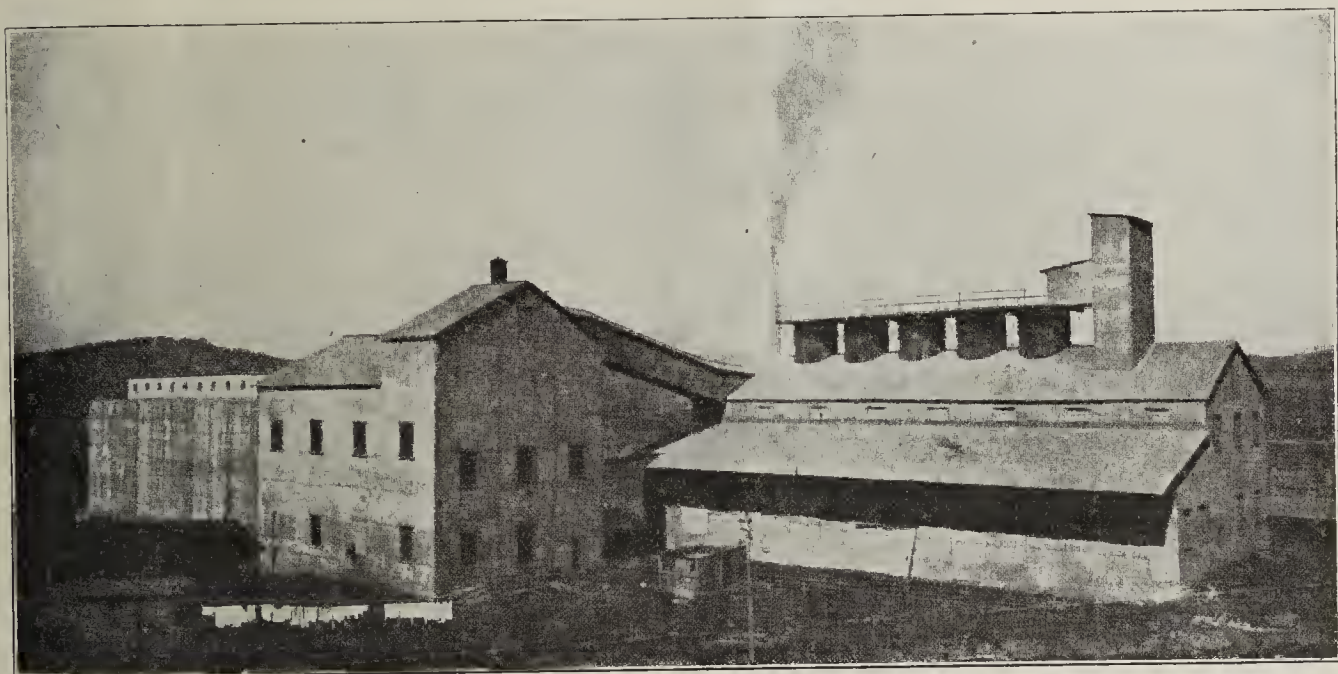
The new lime plant recently completed under the design and supervision of Richard K. Meade & Co., engineers, of Baltimore, has a daily capacity of 60 tons of lump lime, 76 tons of hydrated lime, and is also equipped to make agricultural ground limestone, having Williams improved pulverizers for grinding purposes. The potash recovery plant uses the Cottrell system of electrical precipitation, which recovers $4\frac{1}{2}$ tons of potash daily from the raw materials now being used, but with the use of other materials readily available, at least double the potash output can be secured. The potash salts obtained will consist largely of potassium and sodium sulphates and chlorides with a trace of sulphides. Both plants, which are housed in fire-

pulverized limestone shipments and the one nearest the hydrating building serves the hydrating plant.

All machinery throughout the lime plant is driven by Westinghouse motors, current being furnished from the central plant already referred to. In some instances, the machinery is driven by individual motors but in others the machinery is arranged for group drive. This arrangement is generally employed where an elevator and conveyor carry away the product from a machine, when all units are driven by the same motor.

The plant is supplied with stone from the same quarry which furnishes limestone for the cement plant. It is located at Speer's Ferry, Va., on the C. C. & O. Ry. The company has also other valuable limestone deposits under its control in this locality, one of which is now being developed as a future source of supply.

The limestone at Speer's Ferry is a crystalline white limestone which can be broken up easily by sledges to a size suitable for the lime kilns. Its purity is evident from the following analysis: Silica, 0.70; alumina, 0.45; iron oxide, 0.25; lime, 54.58; magnesia, 0.62; loss on ignition, 43.16.



General View New Lime Plant, Clinchfield Portland Cement Corporation.

proof buildings, are thoroughly modern, employing the latest and most improved ideas in equipment and operation, and are a fit complement to the company's equally modern cement plant.

Two-thirds of the output of the lime plant is used by the industries of Kingsport, Tenn., but the plant has been so laid out that additional units can be added at any time to increase the capacity to meet any demand that may arise from the establishment of new chemical, electrochemical and associated industries in the South.

The new lime plant has five vertical steel kilns, in the eastern end of which building is located the Williams pulverizer for preparing agricultural ground limestone; a hydrating plant and four reinforced concrete silos for the storage of hydrated lime. The stone bins are to the north of the lime kiln building and 27 feet away. The lime plant and hydrating plant are connected by means of an overhead bridge, in which are located the conveyor which brings the lime from the kilns to the hydrator. The two shipping tracks run between the two buildings and under this bridge, the track nearest the kilns being for lump lime and

This limestone burns fairly easily, holds its shape well in the kiln and makes a compact white lime. The limestone for the cement plant is now loaded by steam shovel and crushed at the quarry, but the stone for the lime plant is taken from the purest ledges, hand sledged to proper size, loaded on small cars and dumped into a bin from which in turn it is dumped into gondola cars and sent to the plant, 20 miles away.

Limestone Storage Pockets

On arrival at Kingsport, the stone cars are pushed up on to a trestle over the lime plant storage bins. These supply only the lime plant, the cement plant having its own bins. There are 12 of these bins, some of which are used for coal and for limestone to be ground for agricultural ground limestone. The total capacity of the bins is approximately 1,500 tons of stone. These bins have concrete bents while the fronts are of heavy timber framing covered with 3-inch planks. The track is supported on timber girders, the space between them being clear. Each bin has an iron chute closed by a swinging gate, through which the stone is discharged. The earth fill of the incline leading to the coal storage trestle of the cement plant, runs

parallel with the stone storage and this forms the back of the bins. The bins are not entirely self-emptying—about two-thirds of the contents can be drawn by gravity and the balance, which is only designed as a reserve supply in case of extreme need, must be shoveled out.

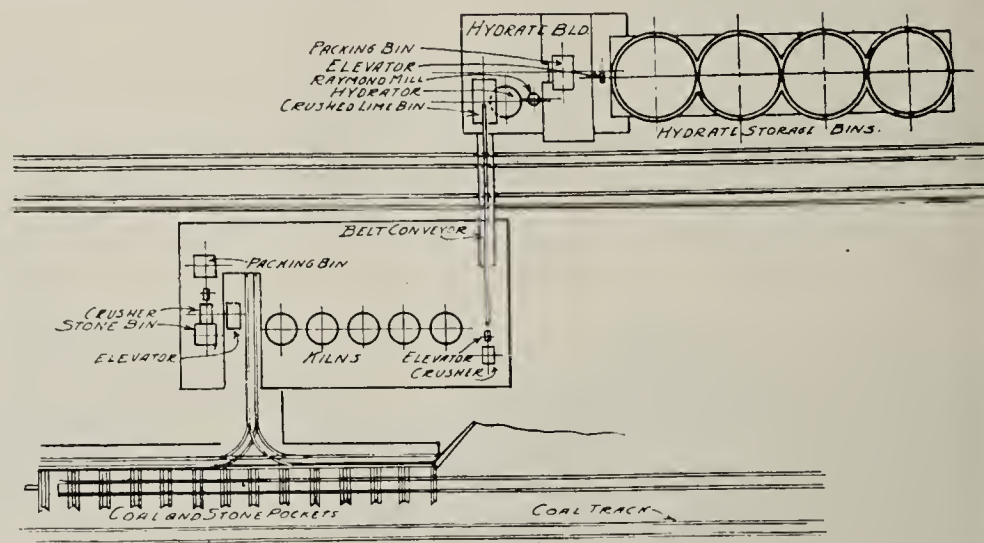
A track extends in front of the stone bins and 9 feet below the bottom of them and the stone is discharged through the chutes into small cars which are pushed along this track into the lime plant. The track is covered by a shed so that the drawing of stone and its conveyance to the lime kilns is not interrupted by bad weather.

The stone cars after entering the kiln building, are pushed onto a platform elevator. This elevator is of the type generally employed in factories and is electrically operated from the platform, the hoisting apparatus being located overhead. This elevator may, of course, be stopped at any point, but is provided with three regular automatic stops—one at the firing floor so that coal for firing the kilns may be brought up on it; one above the bin holding limestone to be pulverized for agricultural ground limestone, so that stone for

cooled by the air circulating around it. The bottom of the cone is closed by means of a pair of doors which swing from a point on the cone and are pulled outward when the lime is to be discharged and pushed shut when this has taken place, by a pair of levers. The cone is far enough from the floor to allow a car to be run under the doors, into which the lime is discharged, while the levers are so placed as to be accessible and yet out of the way when not wanted. There is thus a clear passageway around the cone. The lime to be hydrated is carried out from under the cone to the north side of the building and that to be shipped in lump form to the south side. This allows a clear floor 43 feet 6 inches by 120 feet on the track or south side of the plant on which the lime may be spread and sorted without interfering with the drawing and crushing of lime for the hydrator, this being confined to the rear of the building away from the shipping.

The coal for burning is brought up in small cars by the elevator and dumped on the firing floor in front of each furnace.

The track by means of which the kilns are charged passes over one side of the kiln so that the cars dump



this latter purpose may be dropped into this bin, and a third stop level where there is a charging track which runs over the kilns. The ease with which coal and stone may be delivered at three different points with this elevator by one man, who fills the car, rides up with it and dumps it, makes the elevator far preferable to the ordinary incline.

Lime Kilns

The five kilns were especially designed for this plant by the engineers, Richard K. Meade & Co., Baltimore, Md., and each consists of a steel shell 11 feet in diameter and 49 feet 6 inches high. They rest on a solid block of concrete and the bases of the kilns are concrete. The kilns are each equipped with two furnaces, one on each side.

These furnaces are supported on a reinforced concrete floor 12 feet high, which extends on each side 21 feet beyond the center line of the kilns, giving ample space for the burners to work and for piling the coal, etc.

The kiln shell is divided into three parts. The upper 5 feet 6 inches is unlined with brick and forms a bin for the storage of stone so that the kiln does not have to be continuously charged. The middle section, of about 32 feet is lined with fire brick and in this the stone is burned. The lower section is unlined, is cone shaped and so placed that air can pass freely around it. This cone forms the cooler which receives the red hot lime from the hot part of the kiln and in which it is

the stone directly into the center of the kiln, giving an even distribution of the charge. The track is supported on light steel I-beams, and a platform of perforated metal, supported by brackets and enclosed by angle iron railings, runs around the top of the kiln and between the rails.

Pulverized Limestone Plant

The pulverized limestone plant occupies two panels or bays of the kiln building. The equipment of this consists of a No. 3 Williams hammer mill equipped for grinding. The stone to be pulverized is crushed to 2½ inches at the quarry. It goes into the storage bins at the plant, just as all stone does, and from these is carried by means of the car and elevator up to the level of the top of the bin above the Williams mill. Here it is pushed off on to a track running over this bin and dumped. From this bin it is fed automatically to the mill which reduces it to a fineness of 20 mesh and under. The product from the Williams mill is elevated by means of a chain bucket elevator and when the product is desired in bags it is dumped into a steel packing bin, but if bulk shipment is to be made the ground limestone is spouted directly from the discharge of the elevator into the cars. The packing in bags is done by a spout and valve and a pair of platform scales.

The lime to be hydrated is drawn from the kilns into small cars holding about one ton and these are pushed to the west end of the building where a small (No. 1) Williams mill is located. The lime is first

weighed and then dumped into the mill which crushes it to about 10 mesh and under. The product from the mill goes into the boot of a bucket elevator and is carried up and discharged on to a belt conveyor running in the bridge connecting the two buildings of the plant. This belt carries it over into the hydrating building.

Hydrating Plant

The lime, arriving at the hydrating building, is discharged from the conveyor directly into a large steel storage bin having a capacity of about 75 tons. Below this bin are located in succession a pair of hopper scales and the hydrator.

The lime is drawn as desired into the hopper of the scales, 2,000 to 2,500 pounds, constituting a charge, and dumped from this into the Clyde hydrator. When hydration is complete the charge drops into a steel hopper below.

The fully slaked lime as it comes from the hydrator is in the form of a very fine powder, containing an occasional piece of over or under burned lime, silicious cores, etc., and some clots of hydrate. In order to eliminate the first and break up the clots, the hydrate is fed out of the hopper by an automatic feeder into a screw conveyor which carries it to a No. 1 Raymond mill, equipped with a No. 11 exhaustor and 8-foot collector, the latter located above the packing bin. The mill is provided with an automatic throw-out which discards from the hydrate any pieces of unburned limestone, lime which has not fully hydrated, and silicious cores.

The tailings, consisting as they do of material high in lime, drop into a small conveyor and are elevated into a bin at one side of the plant. From this they are drawn at intervals into a dump cart and carried over to the pulverized limestone plant where they are mixed in with the limestone, ground, and the mixture sold for agricultural purposes.

The finely ground hydrate, free from impurities, may be discharged from the collector of the mill either directly into the packing bin or else into a system of conveyors and elevators which carries it into the storage silos. The excess air from the collector is led into a stocking or tube collector and the dust, consisting of the finest hydrate, is removed from it there. This very fine product is usually sold as a special product to those desiring a superfine hydrate—for example, to the manufacturers of lubricating greases.

The packing bin is located directly above an Urschel-Bates valve bag packer which has four tubes and is direct connected to the small motor which drives it. It is equipped with a dust collecting device so that the dust and spill will not annoy the packers.

The floor of the packing machine is on a level with the floor of the cars and the bags are trucked directly from the packer into the cars.

Concrete Storage for Hydrate

The hydrate storage consists of four reinforced concrete tanks or silos, each 30 feet inside diameter and 31 feet high. The walls are 6 inches thick and properly reinforced with horizontal and vertical steel rods; 15 per cent of the cement was displaced by hydrated lime in the concrete for the walls and roof in order to waterproof them. The tanks are roofed with a concrete slab supported on reinforced concrete girders. The screw conveyor carrying the lime into the tanks is in a small reinforced concrete monitor running over the tanks and supported on two concrete girders.

The tanks rest on a concrete slab supported on concrete walls and piers—this slab also forming the bottom of the silos. Four screw conveyors run under the tanks and extend into the hydrating building where

they all discharge into a common cross conveyor. This latter discharges into an elevator which in turn discharges into the packing bin. The hydrate is drawn from the silos into these conveyors through spouts provided with gates. These four silos provide storage for about 2,000 tons of hydrate and are designed to allow the plant to run at all times.

Superintendent Newaygo Cement Co.

Walter T. Groner has resigned his position as superintendent of the Newaygo Portland Cement Company, Newaygo, Mich.

One hundred and forty employees of the Sandusky Cement Co. at Bay Bridge, O., were given a two per cent bonus, based on their yearly earnings, as Christmas gifts. Over \$5,000 was distributed.

Director-General McAdoo has just authorized the publication of reduced rates on cement by cardinals, minimum weight 50,000 pounds, to Oswego, Ore., and Irvin, Wash., from stations in Oregon and Idaho on the Oregon Short Line Railway.

"The rates established," says the announcement, "will place the above producing points on a parity with rates now in effect from other shipping points."

New Raw Grinding Machinery for Phoenix Cement Plant

The Phoenix Portland Cement Co., with offices at Philadelphia, have placed an order for a Bradley Hercules Mill installation for the grinding of raw material.

This company is purchasing the most up-to-date equipment obtainable. The Bradley Hercules Mill installation will be used as a preliminary pulverizer before tube mills. The use of the Bradley Hercules Mill as a preliminary pulverizer is meeting with great favor among progressive cement manufacturers, as it produces an extremely large output when pulverizing to a fineness of 50 per cent through 100 and 40 per cent through 200 mesh sieve. This extreme fineness which is uniform at all times, makes an ideal feed for the tube mill, increasing the capacity in many cases 25 per cent and ultimately reducing the horsepower consumption of the entire grinding unit.

Recent installations of the Bradley Hercules Mill are: Cuban Portland Cement Co., Mariel, Cuba.

International Portland Cement Corp., Argentine, S. A.

Dewey Portland Cement Co., Dewey, Okla.

Lehigh Portland Cement Co., Oglesby, Ill.

The Bradley Pulverizer Co. of Allentown, Pa., declare that it is their belief that never in the history of the cement industry has a pulverizer met with the success that has been the history of this machine.

Concrete Steamer Leaves Ways Down in Georgia

The reinforced concrete steamship *Atlantis*, 3,500 tons carrying capacity, was successfully launched last week at the yards of the Liberty Shipbuilding Co., Brunswick, Ga.

The *Atlantis* is the first of the concrete ships contracted for by the United States Shipping Board Emergency Fleet Corporation, to be finished. Sister concrete ships as well as a number of concrete ships of 7,500 tons capacity are being built in the yards of the Liberty Shipbuilding Co., and in four other yards established by the government exclusively for concrete ship construction.

The Jones Speed Reducer

The Jones Spur Gear Speed Reducer is an enclosed spur gear drive so designed and constructed that all moving parts operate under ideal conditions in an oil bath. It resembles somewhat in general appearance an electric motor, and is usually about the same size as a motor of corresponding horsepower although in cases where a very great ratio is provided it is somewhat larger.

The gears and bearings are naturally the vital points of any speed reducing device, and for this reason their selection and arrangement has been studied with special care. Practically all worm gears are inefficient and at high speeds there is always danger of heating and cutting. Bevel gearing is also undesirable while internal gears with either planetary or non-planetary motion require a complicated mounting, and also have a tendency to become noisy under constant service.

In order to overcome these objectionable features all reductions are accomplished by means of plain spur gears only, forged of special analysis steel with accurately generated teeth. The tooth form employed is the involute stub with twenty degree pressure angle which insures greater strength, more even wearing contact, less friction, better efficiency and longer life than the standard fourteen and one-half degree involute.

The high and slow speed shafts are concentric and have the same direction of rotation. Gear shafts are ground to size and supported at both ends in liberal bronze bushed



bearings eliminating all overhanging elements subjected to transverse loads. The simplicity of this construction can be fully appreciated when it is likened to the ordinary spur gear drive, the only difference being that by taking advantage of three point contact smaller gears may be used in the reducer which are suitable for enclosing in a housing. Pitch line speeds are also decreased, on account of the small diameter of the gears, to such an extent that high speed motors are not objectionable and may be used without causing excessive pitch line speeds for gears of this description.

A substantial cast iron housing with removable heads totally encloses all gears and bearings. The housing is compact and neat in appearance and provides as an integral part, the bronze bushed bearings insuring correct alignment of the gears and shafts with the proper meshing of the gear teeth. Lubrication is automatic, a copious supply for all internal moving parts being insured by splash. An oil gauge furnished as part of the regular equipment indicates the proper level of oil to be maintained in the housing. All parts are easily accessible for inspection as the gears and shafts may be completely withdrawn from the housing by simply removing the heads.

Standard reducers suitable for all motor speeds are

manufactured ranging from one horsepower up to three hundred and almost unlimited reductions can be obtained. Experience has indicated however that there is a comparatively small demand for ratios greater than one hundred to one. For line shaft and similar service ratios from four to one up to nine to one are usually employed, while for driving elevators, conveyors, dryers, agitators, mixers, screens and similar machinery, where a considerable reduction is customary between the motor and driven shaft, reducers ranging from twelve to one up to seventy-five to one are very common practice.

This method of transmitting power with a reduction in speed has extended to all forms of industry, but is particularly valuable and satisfactory as applied to cement mill drives on account of the direct, durable, positive, and economical method of operation which is assured under extremely severe conditions of service. Also the wide range of adaptability permits many combinations or simple forms of drive arrangement to be secured, so that it is often practical or advisable to drive two or three or more separate machines from one motor and reducer at the same time, greatly simplifying the transmission otherwise necessary.

In addition to compactness and the saving of space this reducer is so simple in construction that once installed it needs no further attention outside of an occasional oiling. No expert or skilled attendance or adjustment is ever necessary. It is dust proof and fool proof, eliminates at once all troubles common to belts, open gears, chains or ropes such as stretch, misalignment, lack of attention, excessive wear due to insufficient lubrication or adverse atmospheric conditions. It is also an absolute protection to careless or indifferent workmen against injury by coming in contact with dangerous, rapidly moving parts, as the totally enclosed feature eliminates entirely all such hazard.

Where abrasive materials are being handled and the air is full of dust, the operation of belts, open gears or chains is unsatisfactory, the length of life is necessarily short and renewal charges excessive—sometimes almost prohibitive. Conditions of this kind have absolutely no detrimental effect on the speed reducer, its efficiency is unimpaired as the moving parts are protected from dust, grit, and all foreign matter, so that it is free to operate successfully without excessive wear or maintenance regardless of the surroundings. Direct connection to the motor is made by a flexible coupling so that all side strains on the motor shaft and bearings are eliminated.

Frequently the cost of a speed reducer is less than the total expense incurred in providing any other form of complete drive to accomplish the same reduction in speed. Owing to the large ratio possible with a reducer it is often advisable to use a higher speed motor in connection with such an installation as they are less expensive and usually have a slightly better efficiency. The millwright work necessary to install a reducer is much less than that required with any other method of drive and gear guards or other forms of protection for safety do not have to be furnished or installed. Maintenance charges are hardly worth mentioning on the reducer, even under severe conditions and continuous service, and adequate lubrication at minimum expense is assured as no oil is wasted.

Each reducing problem is given a complete engineering analysis insuring the selection of a machine amply proportioned for the full duty to be performed. This does not consist merely of a study of conditions under which reducers are to be installed and operated, but the tooth load on each gear and pinion is checked to make sure that the pressure is well within the limits which experience and good engineering practice has shown to be safe and

conservative at the given speeds. Likewise the strength of the shafts are checked and the pressure per square inch of projected area of each bearing is investigated to insure durability and long life in these important parts.

Perhaps such extreme care along this line may seem tedious or unnecessary, but it is largely responsible for the successful and satisfactory operation of each and every machine, which the customer has a right to expect, and accounts in a large measure for the great popularity which this type of speed reducer has attained wherever it has been employed. Write the W. A. Jones Foundry and Machine Co., 4406 West Twelfth street, Chicago, for catalog.

Blast in Quarry Injures Foreman

John Reynard, foreman for the Ash Grove Lime and Cement Company, was seriously injured by a dynamite blast in one of the company's quarries at Ash Grove, Mo. His condition is considered critical. Physicians state that he was suffering from internal injuries in addition to the wounds about his head which completely destroyed one eye.

The accident occurred on January 15th. Thirty blasts had been set but one of them failed to go off. Mr. Reynard started to investigate but just as he reached the place where the blast was set it exploded, blowing him several feet into the air. He fell on the edge of an incline and rolled to the bottom of it, a distance of about 10 feet.

He was picked up unconscious and rushed to a hospital by Frank Culbertson, superintendent of the lime company. It is believed at first that he had only been stunned by the injuries to his head, but an examination showed that he had been seriously wounded internally.

Raymond Pulverizers

The Raymond Bros. Impact Pulverizer Co., 1331 North Branch street, Chicago, have made their newest catalog, No. 13, a compendium of usefulness. For it is not only a catalog of the Raymond products, roller mills and pulverizers, with air and screen separation for grinding all kinds of materials to powdered form, dust collectors and accessories, but it contains some very good general ideas regarding pulverizing problems. Word and illustration and tracing help to a good understanding of the whole subject. It is a complete and interesting catalog of grinding machinery, printed in the printer's best art.

To Build Concrete Barges

One of the largest concrete barge building plants in the United States is being constructed at Port Aransas, Texas, by the MacDonald Engineering Company, according to further development of the original plans. It is stated that the plant will be of initial capacity to construct ten oil-carrying barges, involving a total outlay of about \$1,000,000. Each of the barges will be 270 feet long, 35-foot beam, 21-foot draft and have a carrying capacity of 12,500 barrels of oil.

The order for these barges is from France to the Canada Oil Transport Company of New York, which is preparing to transport Mexican oil through this port on an extensive scale. The company will operate a regular line of concrete barges between Tampico and Harbor Island, situated just across the channel from here, and between Tampico and European ports, it is stated. The MacDonald company is building a 1100-foot wharf and three standard 55,000-barrel concrete oil storage tanks.

Westinghouse C. S. Motor Strafes Forty-Four Pilers

In order to understand this calamity, a little mental setting-up exercise will make it clear. Given 800 barrels of 140-pound jute sacks of flour or wheat to be piled 16 feet high, by the good old back-twisting method; 6 pilers can do the job in 10 hours; banking on the supposition, of course, the 6 pilers are always available. How long will it take one piler?

Sixty hours.

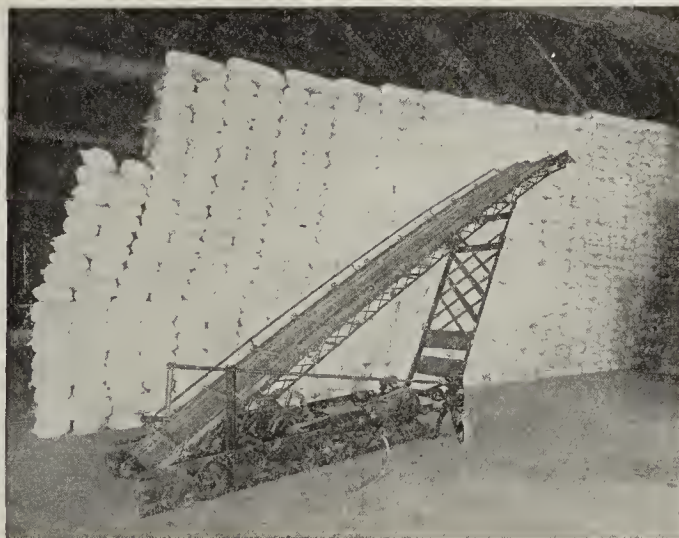
Right!

Easier yet! How many pilers will it take to pile this same flour in one hour?

Sixty pilers.

Right again! Kindly bear this in mind: That it takes 60 men one hour to pile 800 barrels of 140-pound sacks of flour. That is, it does, providing the conditions stated above are given.

In 1917 these conditions were actually given at the Pasco Flour Milling Company's Mill at Pasco, Washington. But this company, unusually progressive in finding and installing labor-saving devices, today are performing the same operation with 4 men working 4 hours, using the new Piling Machine shown in the il-



Piling Machine, Driven by Westinghouse Motor. Illustration. In terms of man power, it takes 16 pilers one hour, as against 60 pilers by the old method.

This machine, then, has actually strafed forty-four men.

The machine looks considerably like an incline in a modern department store. It is manufactured by the Brown Portable Conveying Machinery Company and is operated by a 3 horsepower type CS Westinghouse motor. These machines are portable, and are adapted to a dozen different kinds of material, from handling sugar to baled hay.

This machine, here, also displaced an old block and tackle method formerly used to hoist empty sacks to the space above the rafters in the warehouse.

It is also used for unloading wheat from cars into the warehouse. Two men on a pile and four chackers can handle 400 sacks per hour.

Cement Gun Plant for France

The Cement Gun Company, Inc., Allentown, Pa., organized by S. W. Traylor, president of the Traylor Engineering Company, will build a plant in France for the manufacture of the Traylor cement gun, to be used in reconstruction work in that country. A site is to be acquired along the Seine in the manufacturing section of Paris. The plant to be erected will cost about \$500,000. Construction work will begin in February.

Modern Limestone Plant in Eastern Tennessee

The American Ballast Company has one of the largest pulverized limestone and stone crushing plants in the South and the demand for their product far exceeds the capacity of their plant.

The company's plant, an illustration of which is given, is located at Mascot, Tenn., 13 miles east of Knoxville on the Southern Railway. It has a capacity of 1,000 tons of ground limestone daily. The rapid increase in the use of ground limestone by the farmers of the South is due to the patriotic appeals to them to increase their crops and to the persistent campaign of education as to the value of ground limestone as a fertilizer, carried on by national, state and quasi-public corporations.

The American Ballast Co., which has a thoroughly modern plant, is selling its "Mascot" ground limestone mostly in the Carolinas, Tennessee and Georgia. It sells its product direct to farmers, and while its salesmen are soil experts, it recommends that farmers secure advice from county agricultural agents, maintained in all of the states named, as to the requirements of their soil.



Modern Limestone Crushing Plant of the American Balast Co., at Mascot, Tenn.

This company also has a large production of crushed stone, handling 3,000 to 4,000 tons daily. This is sold for concrete, ballast, asphaltic concrete, roofing gravel, going all over the South as far as Tampa and Miami, Fla. The latest addition to its line is limestone dust, which is being used for asphalt filler, meeting not only the physical requirements, but, according to the report of Dow & Smith, chemical engineers, New York City, it shows passing 200 mesh, 84.5 per cent; passing 100 mesh, 14.5 per cent; passing 80 mesh, 1 per cent. Solubility in hydrochloric acid was 89.35 per cent mostly carbonate of lime. Dow & Smith further said: "This is an absorbent limestone dust very finely ground, and one of the best limestone dusts we have examined for asphalt filler."

Owing to the steady increase in the use of asphaltic surfaced roadways and streets, the company expects to have a continual and substantial growth in the sale of this filler.

The home office of the company is at Knoxville, Tenn., with Thomas McCroskey as general manager.

Sand and Gravel Producers Convention

Harry Donnelly of Cincinnati was re-elected president of the National Association of Sand and Gravel Producers at the closing session of its third annual meeting

in the Hotel La Salle, January 29th and 30th, and E. Guy Sutton of Indianapolis was re-elected secretary. Resolutions were adopted requesting an immediate announcement of the federal policy regarding ownership of railways. Promotion of public works that will provide employment for returning soldiers and sailors also was advocated.

\$2,650,000 Crushed Stone Merger

Big Eastern Interests Consolidate to Cut Cost of Production

Putting into effect practical efforts to cut the cost of construction to consumers, a \$2,650,000 merger of eight great stone crushing plants supplying the New York market will be perfected this week.

The deal involves seven plants located at various points along the Hudson River and one at East Haven, Conn.

The new company is to be known as the New York Trap Rock Corporation, and will have its headquarters at 131 Park avenue, New York, with Nathaniel D. Lancaster, president; Mortimer D. Wandell and James

J. Shaw, vice-presidents; R. W. Jones, Jr., treasurer, and R. E. Desbernini, secretary. The directors are to be Wilson P. Foss, long identified with the crushed stone interests of New York; John E. Mead, ex-Governor of Vermont; Nathaniel D. Lancaster, Mortimer D. Wandell, James J. Shaw, William A. Barber, R. W. Jones, of McBee, Jones & Co., bankers; C. C. Dickson and J. J. Williams. The financial interests in the enterprise were represented by R. W. Jones, of New York, who made the following statement:

"Completion of our negotiations is the culmination of a general belief in the great future for building and road construction and the imperative necessity for transacting business without regard to 'kind' along intensive lines. Under the unification of these plants much can be accomplished in putting the building market in more stable condition. The capitalization will be \$2,650,000, divided into \$750,000 first preferred cumulative bonds, \$400,000 second preferred non-cumulative bonds and the remainder in common stock. Incorporation will be under the laws of the State of New York.

"The two principal companies involved in the transaction are the New York Trap Rock Company, now at No. 17 Battery place, and the Upper Hudson

Blue Stone Company, at No. 26 Cortlandt street. Except for the plant of Calvin Tompkins, at Tompkins Grove, L. I., the combination practically embraces all the stone crushing establishments supplying this market through either the North or East rivers.

"Simultaneously with this announcement other road building interests began to prepare for the coming movement in road work and building construction. The tar and oil interests announced that road contractors could rely upon prices running about the same as present levels, and there is every indication before the next month elapses the various boards of freeholders and county supervisors will have passed enabling legislation to permit road improvement work to start very early in the spring.

"The current quotation on crushed stone is approximately \$1.85 a cubic yard, whereas one year ago the price was \$1.65, and the year before \$1.20; a normal rate is about eighty cents a yard."

Prospects Better Than for Several Years

We are optimistic as to business conditions. As soon as the armistice was signed our business began to pick up rapidly. Our prospects are now better than for several years, writes J. C. Steele & Sons, brick machinery manufacturers, Statesville, N. C. The finances of this country are in such good shape that we look for unusually good business conditions generally, with very little time lost for readjustments. While we look for some decline in prices generally, we don't think they will reach the level of before the war—not for several years at least.

The manufacturing facilities of this country, when turned back from war work, may soon cause an overproduction unless we secure foreign markets. This our government should help to do.

We also want our government to see that the large interests, many of whom have profited greatly by the war, do not use their large influence to throttle the smaller manufacturers.

Cement Mills News

Stockholders and directors of the Fort Dodge Portland Cement Corporation held their annual meeting recently in Fort Dodge, Iowa. Directors were chosen as follows: Hon. B. F. Carroll of Des Moines, T. A. Van Alstine, H. S. Van Alstine and L. H. Van Alstine of Gilmore City; Albert Shindelar of Kalmar, Fred Spies of Graettinger, O. M. Olson and M. J. Nicholson, Fort Dodge, Ia. The business outlook for the ensuing year was discussed and reports of the past year given. Following the stockholders meeting a directors meeting was held and the following officers elected for the new year: M. J. Nicholson, president; L. H. Van Alstine, vice-president; H. S. Van Alstine, secretary and treasurer, and T. A. Mair, general manager.

The stockholders of the Nebraska Portland Cement Company, which is located at Superior, Neb., recently held their annual meeting. After business was transacted and the year's reports given they went through the plant. Many of the new machines which have been lately installed were in operation.

The construction work has been in progress for two years. Nearly two hundred and fifty men have been employed. It is thought that they will begin the process of making cement sometime in February. Two hundred men will be employed. The Nebraska Portland Cement Company has one of the largest plants in the United States and the only one in the state of Nebraska.

"Automatic" Scales

"Automatic" scales should be used where repeated weighings of a like quantity of the same material must be made, or where the weight of a material in bulk must be obtained in the course of its transfer from one department to another; or where several ingredients are used by proportional weights.

In this article such scales as pertain to the ingredients of the cement industry, viz., clinker, gypsum, rock, coal, shale, limestone, etc., and which successfully perform repeated weighings of a predetermined amount will be referred to, it being understood that these scales are always adjustable within a certain range.

The best class of this equipment is found with mechanical feeds particularly suited to the material to be handled, with buckets of design and construction to withstand the rough usage imposed, the mechanism such that the supply doors and valves cannot be open at the same time and permit unweighed material to pass through. Graduated poise weights provided. A register to record each discharge of the scale. It can be set, too, for a given number of discharges and when they have passed through the scale will mechanically lock the machine and prevent further operation until re-set. It also alarms or signals the plant manager's office and shows either continual or intermittent operation.

The main thought in the design, construction and manufacture of automatic scales is that they are to receive a continuous supply of material to be weighed, the material arriving in lumpy, granular or powdered form. Even in the weighing of a single commodity there are various conditions to be overcome, such as irregularity of stream, a change in specific gravity of the material, atmospheric or humidity changes, all of which affect the nature of the material. A successful scale must be so constructed that it will meet and overcome these varying conditions.

The truly "automatic" scale receives the material and by self-contained mechanical means feeds it in a constant uniform stream. When the bucket is filled to a point where equilibrium is reached, the supply of the material is cut off. Simultaneously the bucket doors are released and the contents are discharged, the register recording the operation. This process of filling and discharging is repeated as long as desired.

In many cases "automatic" scales are connected in series of two or more for the purpose of proportioning by weight different materials, the scales to discharge simultaneously. Automatic proportioning by weight of ingredients entering into the manufacture of cement is being more and more recognized as the correct method. When scales are used for this purpose they are all governed by a mechanical tripping device, which makes it impossible for one scale to discharge without the others. This feature is absolute, because it is perfectly obvious that although the scales might weigh with extreme accuracy, if not positively governed, the relative proportion of weight could easily be destroyed.

Usually the guaranteed maximum amount of inaccuracy per discharge is one-tenth of 1 per cent, but with some materials it may rise to one-half per cent and in rare cases of one per cent.

In one plant where an installation was made the plant engineer made the following statement: "As a reward for the automatic weighing machine installation, this plant has increased its kiln output a little over 30 per cent, has prolonged the life of the kiln lining, reduced burning trouble to a minimum and has the assurance of a uniform, sound product and has placed its laboratory on an efficient basis."

Scales for the work outlined are made by the Automatic Weighing Machine Company of Newark, N. J., who will be glad to give further information upon request.

Materials Transfer and Storage Hopper

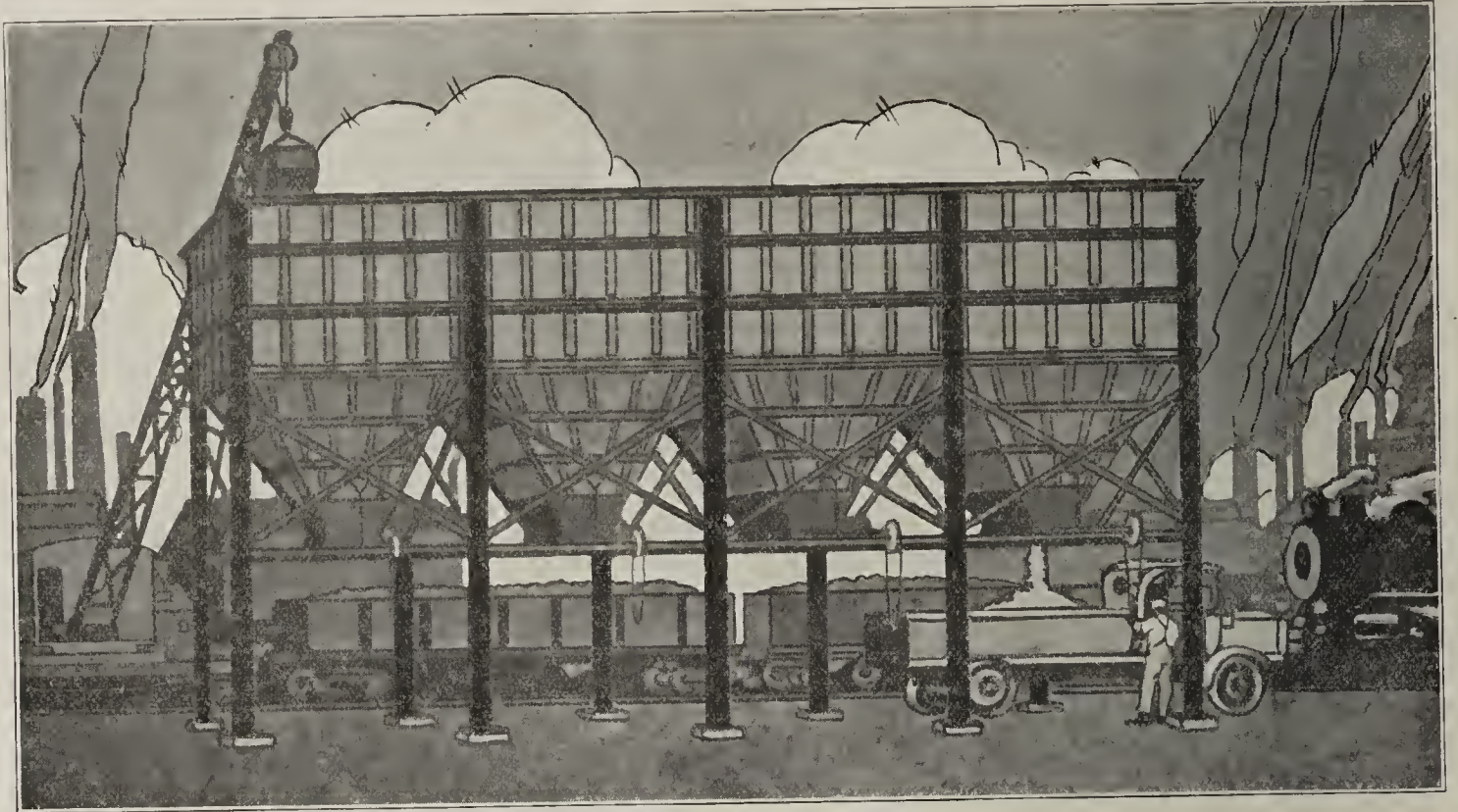
One of the best storage hoppers ever developed in its field of many uses is illustrated herewith. It is manufactured by the Green Engineering Company of East Chicago, Ind., who have the following to say regarding this simple and well-built structure.

"The many objections to wooden bins or hoppers—their short life, high erection-labor cost, construction difficulties, timber wastage, and great fire hazard—have

"Structural iron workers are not required in the erection of the Green Hopper. Unskilled labor will erect this hopper in about one-third of the time required for high-priced structural workers to erect a steel tank of like capacity.

"The feature alone makes the Green Hopper well worth investigating—the marked savings in installation expense.

"The Green Hopper fits in with these times of con-



The Green Cast Iron Hopper Quickly Erected with Unskilled Labor.

long since proven them expensive for most temporary uses.

"Steel hoppers have eliminated many of the objections characteristic of wood construction. But they have certain inherent faults which are but intensified under present abnormal conditions.

"They require steel plates which are practically off the market at this time, due to their use in ship-building. They require structural workers with their outfit of forge, rivets, scaffolding, etc., also much needed in ship yards. The steel plates and the structural labor required in steel hopper construction, expensive in normal times, are to be had at nothing short of prohibitive cost now.

"But the greatest objection to the use of steel lies in its expensively short life in materials storage service. The interior surfaces—those subjected to the abrasive action of the stored materials—cannot be kept painted. It is well known that surfaces of steel must be thus protected. Otherwise, rusting action is swift and deterioration rapid and costly. The universal use of cast iron for water mains is a notable example of this recognized limitation of steel.

"The Green Materials Transfer and Storage Hopper is far superior to steel hoppers because all surfaces subjected to the rusting and abrasive action of the stored materials are of cast iron. Rusting action is negligible. These cast iron surfaces are heavier than the steel plates and are practically proof against corrosive and abrasive action as well.

"This naturally means the Green Hopper outlives the ordinary steel storage tank by many years.

servation—a great saving in the cost between skilled and unskilled labor, plus a $66\frac{2}{3}$ per cent in saving in the time required for erection—double conservation.

"The amply strong supporting structure is built of standard steel sections. They are cut and punched—ready for erection and bolting.

"All steel is furnished painted with one coat of red oxide and one coat of black graphite.



The Green Hopper Gate.

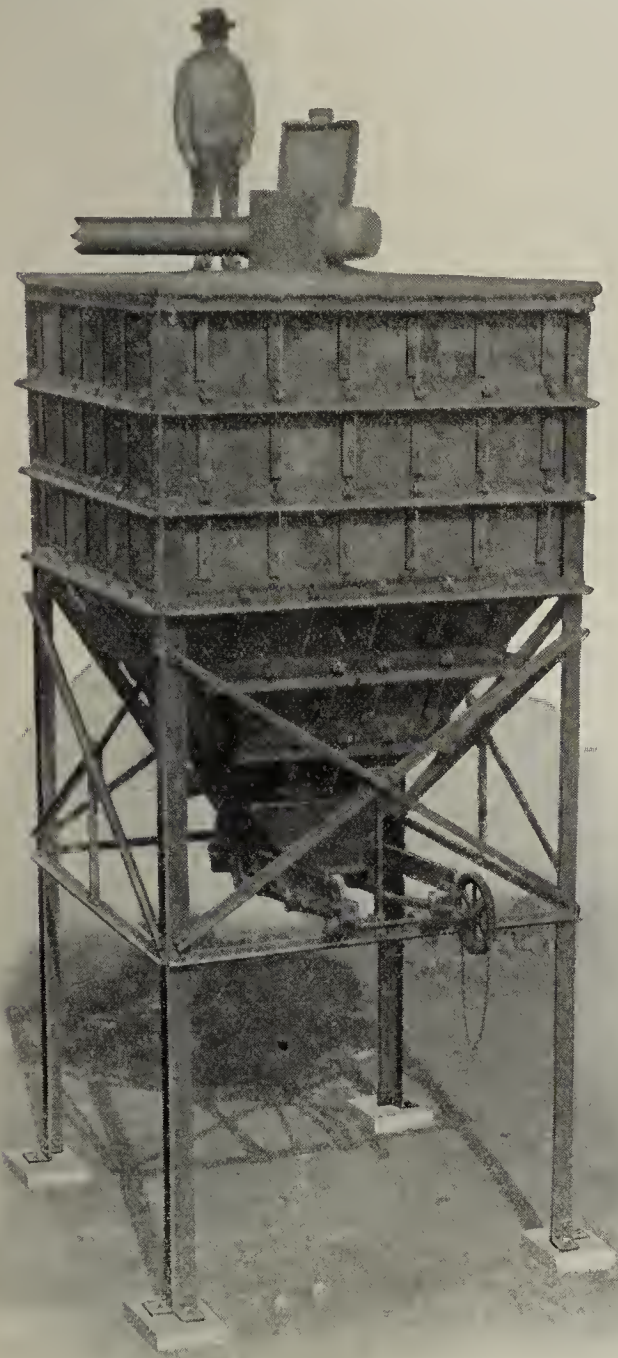
"After this sturdy and quickly-erected steel supporting structure is in place, cast iron plate supports are hooked upon the angle struts of the steel frame. Into the recesses in the sides of these supports are slipped the cast iron side plates and corner plates.

"The efficiency of a hopper is dependent to a great extent upon its provision for quickly discharging the stored materials. Note the strong and rugged construction of the Green Hopper Gate. It is well secured to the upper structure to afford ample support for the

stored materials. It has a large opening, permitting their quick discharge—large enough to thoroughly offset any arching tendency of the materials which might tend to prevent quick discharge.

"This gate is easily operated—mounted upon rollers and actuated by means of rack and pinion gear. It can be attached so that chain which operates gate will come at any one of the four sides—and be changed at any time. This chain can be operated from ground, cars, wagons, etc.

"Not only is the Green Hopper quickly erected with unskilled labor but the materials required for erection are



few. They are such as are generally found in the average plant.

"The simplicity, low cost, and rapidity of erection are obvious advantages—features that have largely succeeded to gain immediate popularity for the Green Hopper.

"Unit hoppers range in capacity from 10 to 45 tons. Manifold hoppers, composed of units with a minimum of supporting structure, can be furnished in any desired capacity. Our engineering department will be glad to correspond with you regarding the possible and profitable ways in which you can use the Green Hopper.

"Consult us upon this even though you have already seen the great savings you can make with it. We are anxious to see every Green Hopper shipped from this plant make good in a big way—our suggestions will prove valuable to you."

A Big Demand for Drain Tile

The National Drainage Congress recently met in Chicago for the first time since the war. Due to the need of conservation of resources during the war, the Drainage Congress has been lying dormant but now seeks to obtain federal aid for reclaiming swamp lands in a manner similar to that followed by the Reclamation Service.

The Drainage Congress has made and formulated resolutions asking congress for an appropriation of one billion dollars, to be used in reclaiming these now worthless lands. Wisconsin alone, one set of figures states, has 2,360,000 acres which are practically worthless. This does not include, of course, all the non-tillable land, but represents that which could be improved to fertile and tillable condition, through drainage alone. As we know, there are vast areas in Wisconsin in addition which are only partially drained and which would have to be cleared from second growth timber and stumpage, in addition to draining before they could become useful.

There is said to be a total of about seven million acres of land in Wisconsin which will need draining. Iowa, Illinois, Michigan, Minnesota and the Dakotas, Missouri, Indiana, Arkansas, Louisiana, Mississippi—in fact, all of the alluvial states—require reclamation through drainage on a vast scale, as well as all of the other states in proportion to the size of their low-lying areas.

When one thinks that the demand for tile has reached its height, it is well to look over data of this kind and reconsider the future for the drain tile industry.

Views with Optimism the Future of American Business

Having an abiding faith in the American business man, and firm in the belief that right will prevail, I view the future of American business with optimism, writes Richard Hardy, president, Dixie Portland Cement Company, Chattanooga, Tenn. We will have problems to solve, but we have the ability to solve them. During the two years just passed we have had ample opportunity to learn our weaknesses and to develop our strength, and we will not fail to take advantage of the lessons taught us by the war. If we carry into the reconstruction period the same unselfish spirit that characterized the participation of American business men in the war, we can face this period without fear. Justice should be the keynote—justice to our employes, to our government and to ourselves.

It is my opinion that this spirit is more highly developed in American business today than ever before, and with this spirit firmly implanted and steadily growing, I see many years of prosperity and happiness ahead of American business.

Launch Concrete Barge

A big concrete barge was launched in the Holler-Davis-Flood Company's shipyard at Fort Edward, N. Y., recently. Three other similar barges are under construction, one near completion, which will be launched within a week.

The barge has a water line of three feet six inches, load line of nine feet six inches, a two-foot beam, depth amidships twelve feet and length of 150 feet and is of 500 tonnage.

Superior Cement Plant Soon to Start Up Again

The Superior Portland Cement Company, Concrete, Wash., is taking advantage of the temporary shut-down to make extensive improvements and repairs in and about the big cement factory, and this work is now well under way. The largest job now on hand is the installation of a new Williams rock crusher with its concrete foundations. The old crusher was found to be too small to meet the demands of the plant, and the new one now being installed is of the latest type, and will have more than double the capacity of the old crusher, and besides is expected to do better work. The construction of the concrete floor and foundations for the big crusher is now about completed, and the installation of the machinery is expected to begin within a few days.

Another big job that is now well under way is the building of new brick furnaces for the kilns. Other extensive alterations and repairs are being made about the plant in order to make it modern in every respect, and incidentally to expedite the production of cement. The plant is already one of the best in the country, and it is the policy to make it still better.

The plant will be put in operation as soon as the construction work is completed, which will be early next month, and present plans are to keep it in continuous operation for the balance of the year. If justified by the demand for cement, the Washington Portland Cement Company's plant, also at Concrete, Wash., will also be placed in operation later in the year. The Superior company is anticipating a large demand for cement this year and are getting ready to fill all orders.

Fundamentals of Cost Accounting for Concrete Products Industry

An unusual feature at the convention of the American Concrete Pipe Association to be held in Chicago February 14 and 15, will be an illustrated talk on the fundamentals of uniform cost accounting system for the pipe and tile industry. This is a basic problem to every manufacturer, no matter what may be his business. The selling price of products is based on the cost of manufacturing and selling. What constitutes overhead is a difficult question in some industries. How records should be kept simply, yet accurately, and how information kept on record should be utilized in cost analysis, are subjects which will be answered and discussed at the convention.

In addition to the analysis of cost accounting, which, by the way, is to be handled by a man who has already installed the system in concrete tile plants, there will be a discussion by the users of various cost systems and a few remarks by an expert appraising company. The appraisal value of a plant at any time will furnish an interesting sidelight on cost accounting.

Economics in Concrete Construction

By C. F. Cramer, Architect, Indiana, Pa.

The Patent Office has just allowed me an invention which may revolutionize the construction of reinforced concrete floors, roofs, steps, etc.

All the expensive preparations, delays and obstructions now being suffered in such work, are obviated in the following manner:

The bearing supports as the permanent walls, partitions, columns and girders being in place, floor, roofs, steps are laid in small interlocking units, which are parallelopiped in form and in full span lengths.

The units are of light weight concrete in sheet metal and (4) Pebble dash; mentions color aggregate stucco

sheaths, reinforced with rods or fabrics of strength desired.

The units may be placed by unskilled labor, each piece being laid before the layer much as logs are laid in a corduroy road, when so laid the units are immediately ready for use, to walk over and work upon.

Floors, steps, roofs, etc., may be laid in any kind of weather or temperature without detriment to the work and without the usual waiting for wet concrete to harden and season. The costs of protecting such concrete work under the old methods are entirely eliminated.

The logs are secured in place by iron anchors at both ends, the reinforced rods being extended, lapping or hooking as desired. Where fabric is used for reinforcement, the iron anchors are cast into the concrete unit.

Steps are run together by filling the troughlike interlocking groove with cement.

The units are to be standardized, "ready-made" in shop, there tested to guarantee, scientifically cared for till seasoned and then stored ready for delivery.

It is proposed that shops and agencies be established in districts, from which finished slabs are shipped comparatively small distance to the job, insuring small freight costs.

The units are provided with holes where desired, for pipe, wires, lighting fixtures, line shafting, fasteners, etc., etc. Wood nailing strips are inlaid in the slab if desired. Pipe space in floors are afforded by cross furring. The work is designed so that it cannot be laid wrong. It is therefore "foolproof."

The comfort of owner and contractor of hurried and delay penalty contracts is imagined when the building is ready to place floors, roofs, steps, etc., to have the complete "ready made" units at the job ready to place; they will probably be elated also that there will be NO WOOD FORMS, CHUTING TOWERS, RUNWAYS or protections to build, maintain or remove.

NO TAMPING.

NO TESTING.

NO RIVETING, bolting, nailing, or screwing. No DELAYS or obstructions to other branches or tradesmen.

SAVING all costs of labor, material and time, the foregoing eliminations would entail.

Lime Value Shown in New York

Fields treated with lime produced an average of 1½ tons of cured hay an acre more than unlimed fields in tests of ground limestone, burned lime, and hydrated lime, conducted by the farm bureau through the county agent in Chemung County, N. Y. A farmer who used 1 ton of ground limestone to the acre secured 4,840 pounds of cured hay, compared to 1,208 pounds on an unlimed acre. Another, who applied 700 pounds of hydrated lime to an acre, obtained 6,292 pounds against 1,461 pounds on an unlimed acre. A third farmer used 1 ton of burned lime to the acre and obtained 3,400 pounds, compared to 1,040 pounds on unlimed land.

Free Book on Stucco

The Atlas Portland Cement Company, 30 Broad street, New York, and Corn Exchange Building, Chicago, will gladly send any of our readers a copy of their new book entitled, "Guide to Good Stucco." It shows three working plans for stucco construction. It illustrates four stucco finishes: (1) Spatter dash, (2) Floated, (3) Stippled, and shows ten exterior color tone effects; contains complete specifications for stucco.

Building a Concrete Water Reservoir

Operating costs and operating time are vital factors in present-day construction.

The American Construction and Securities Co. have recently built a concrete reservoir for the East St. Louis and Interurban Water Co. at East St. Louis, Ill., and their equipment was selected to meet existing conditions.

The inside measurements of the basin are 196 feet by 220 feet and the walls are 23 feet high.

As shown by the accompanying illustration, the concrete was distributed from one hoisting tower. Insley double counterweight chute equipment and Leschen wire rope were used.

The wall had to be poured first, after which a 5-inch layer of concrete was placed over the bottom of the basin in alternate squares. After a layer of asphalt waterproofing had been placed on the first layer of concrete, a second 4-inch layer of concrete was poured.

Both the distributing system and the wire rope on this job were furnished by George F. Smith, dealer in contractors' equipment, St. Louis.

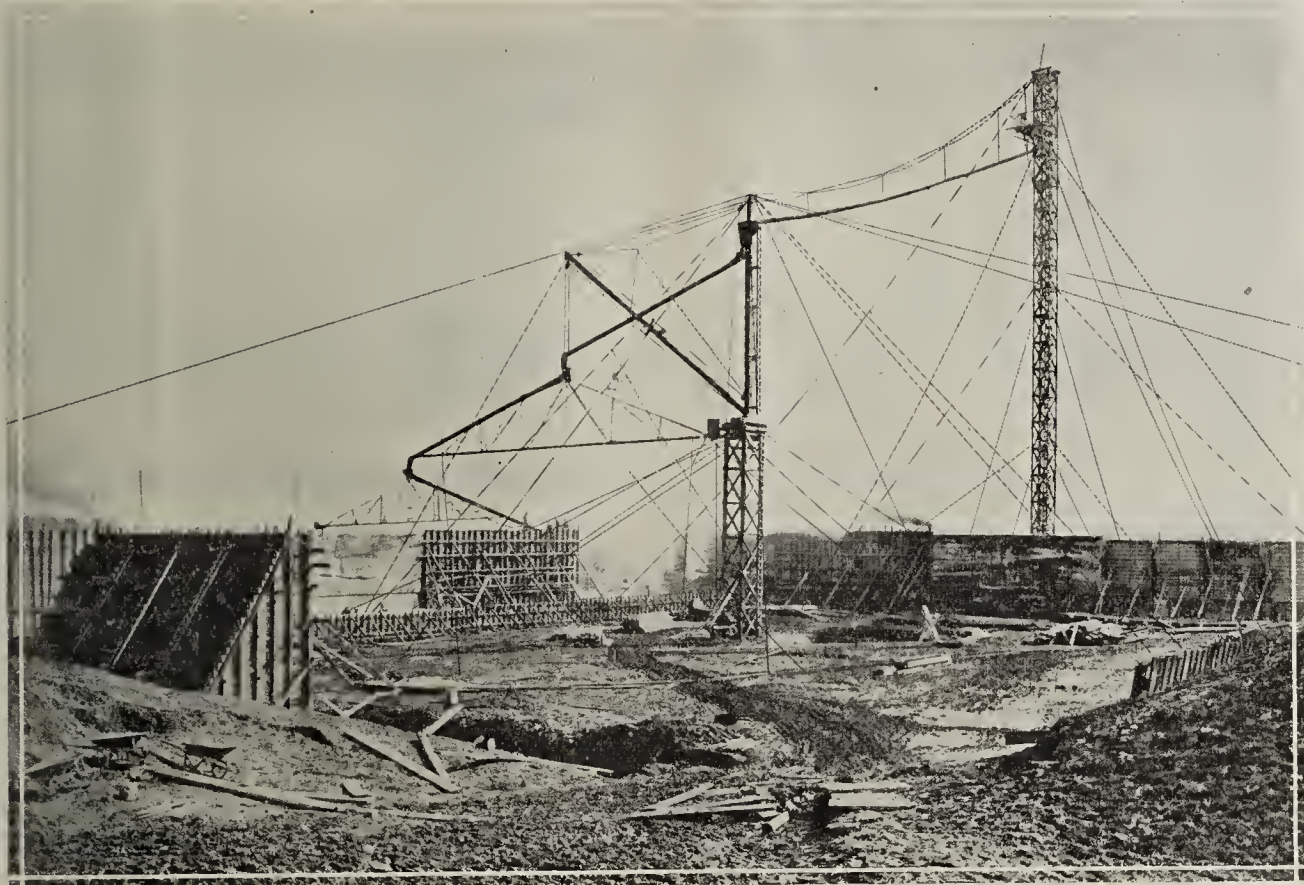
small tank, we would lay three wires on the inner block for at least eight rows of blocks, and then two wires from there on. Of course, the larger the tank, the more reinforcing should be used, and a heavier block. We can make a block 11½ inches thick, the inner part of this heavy block being 6½ inches thick.

"Now, the advantage of this block over solid concrete is this, that there is a continuous air-space to prevent any frost from going through the wall to the inner part of the block. One is never troubled with ice in these tanks.

"After the tank is built, it is given a ½-inch coat of cement mortar mixed with 2 parts fine sand and 1 cement, and after this has set, go over it with a brush and a pure cement wash about as thick as cream, which will be sufficient to make it water-tight."

Concrete Waterproofing

We are pleased to inform you that we have acquired a valuable process for the water-proofing of cement and concrete, and particularly of concrete vessels, writes the William Cail Bitmo Company, 18 Broadway, New York.



This Equipment Distributed Concrete Over An Area of 196 ft. by 220 ft.

Water-Tanks for Cold Weather

Mr. Warren Shaul, of Williamsburg, Iowa, gives his experience in building small anti-freezing water-supply tanks of concrete. He builds tanks of concrete blocks and writes as follows:

"The water tank blocks are made on the same machine that silo blocks are made on, only the machine is adjusted to make a heavier block than the silo block. This machine can be set to give any desired circle, from 9 feet up to 60 feet.

"We first dig down below the frost line, and make a good, solid concrete footing, and then start on that with the air space blocks. We reinforce every course of blocks with No. 3 wire. On the inner part of the block, where the pressure comes, we lay in three of these No. 3 wires, and one on the outer part of the block, the wires being laid in the mortar joint. For a

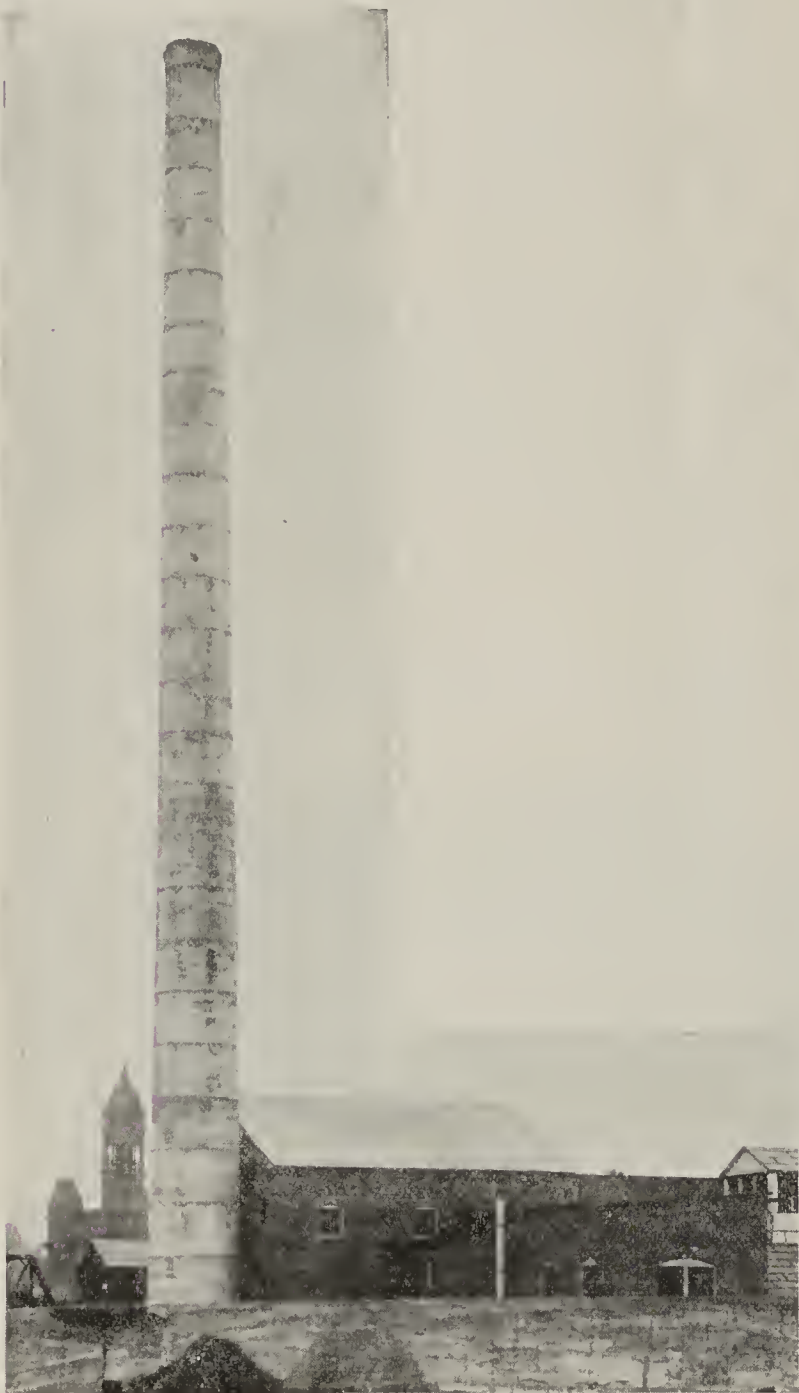
By our process, certain bituminous preparations are deeply impregnated into the structure of the cement, without in any way interfering with the structure itself, except to thoroughly waterproof it. This impregnation takes place either with a paint brush, or with a pneumatic spray, the latter being preferable.

It is well known that Bitumen is proof against practically all acids, also against the action of sea-water, and one result of impregnation by our process will be that the steel reinforcement in concrete vessels cannot be attacked by sea-water. After the impregnation and waterproofing, we apply a coat of semi-bituminous paint, which finds a firm attachment to the impregnated concrete surface, and over which any other paint can be applied with firm attachment and without discoloration.

Believing, as we do, that in regard to practicability, economy and absolute efficiency, our process is far in advance to any other process hitherto used, we have much pleasure in recommending it to all interested parties.

Reinforced Concrete Chimney Built During Winter

Cold weather is no bar to concrete construction if a few simple precautions are taken during the progress of the work. The Wausau Electric Co., of Wausau, Wis., found no difficulty in having this chimney built during last winter when temperatures ranged between freezing and zero. Mixing water and aggregates were heated and the work enclosed with tarpaulins, a stove being placed at the base of the chimney and a salamander up where work was in progress. The chimney shown is 204 feet high with an inside diameter of 7.5 feet. The wall is 12 inches thick at the base and 5 inches at the top.



Concrete Chimney of the Wausau Electric Co., Wausau, Wis., Built During Cold Weather.

"Concreting in Cold Weather," a booklet published by the Portland Cement Association, will give you the fundamentals of concreting practice when work is carried on during cold weather. If you have not received a copy and would like one, send in your name and address.

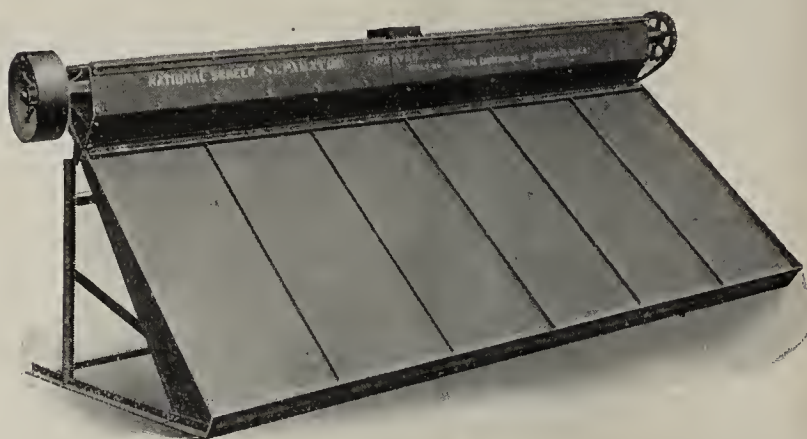
National Screen Separators

Several years ago the National Engineering Company, of Chicago, added a No. 5 screen to its line of National Screen Separators. The screen is 12 feet wide, and

designed primarily to meet the demand of one of the largest gypsum companies in New York state, and, after installing one of these separators, they have since ordered eight more.

The National Screen Separator is made not only with one screening surface, but with two, or even three screening surfaces; one or all of them being agitated as may be required. When the No. 5, or 12 feet wide, separator is equipped with three screening surfaces, it then has 216 square feet of screening surface.

One of the main features of the National Screen Separator is the elimination of the tendency to clog by the use of a unique method of agitating the wire cloth, and which is obtained by stretching wires beneath the wire cloth, these wires being vibrated with considerable rapidity upward against the under side of the wire cloth, the jar being sufficient to keep the meshes clean, and is caused by depressing the agitating wires and suddenly releasing them. The force and number of the blows may be increased or decreased according to the fineness or coarseness of the wire cloth used, a coarse cloth requiring a slightly heavier impact than a finer cloth.



No. 5 National Screen Separator 12 ft. Wide.

The separator is designed with sectional screens each 24 inches wide and uniformly 6 feet long. Each section is provided with three agitating wires. One of the rock shafts vibrates the wire located in the middle of the section, alternating with the other rock shaft which vibrates the other two wires of each section. Thus the central wire, serving as a reinforcing support to the screen panel, is at rest while the two outer wires are in vibration, and vice versa.

The regulation and adjustment of the mechanism permits not only an increase or decrease of the number of blows on the agitating wires, but also permits a blow as light as a mere tremor, or much heavier blows necessary for heavier material.

The agitating wires are snapped at the upper end of the screen and consequently that part of the wire cloth receives slightly more vibration than the lower end. But it is at the point of greatest vibration that the material falls from the distributor onto the screen, and where clogging usually gives the most trouble. Thin strips of steel fastened to the bottom side of the wire cloth protect it from wear due to the snapping action of the agitators.

The mechanism for producing and adjusting the agitation of the vibrators is concealed in a small dust-proof box at one end of the distributing box. The distributor is equipped so as to distribute the material evenly along the entire width of the screen.

The National Screen Separators, numbering from 1 to 5, are made in widths of 4, 6, 8, 10 and 12 feet.

The National Screen Separators are manufactured by the National Engineering Company, 549 West Washington street, Chicago, who will be glad to send prospective customers literature which fully describes and illustrates the machine.

Concrete Ships Blaze the Way

When the United States went into the war and was crying for ships, Messrs. W. J. McDonald and Max Shoolman, who had had considerable experience in building concrete buildings, and with the information at hand of successful experimentation with small ships built of concrete in foreign countries, came to the conclusion that it would be feasible to build concrete ships of large tonnage. They felt that in this way steel would be conserved for other purposes and much time would be saved in construction, as moulds once made could be used again and again and ships could be turned out in very much shorter time than either wooden or steel ships.

Messrs. McDonald and Shoolman were so confident of the success of concrete shipbuilding that they proposed to the government to undertake to build the first concrete ship as an experiment and in case of failure to stand half of the loss. On this basis the government agreed to go into this proposition and a yard was engaged at Brunswick, Ga., for the experiment. After much effort and overcoming many obstacles the first concrete ship, the *Atlantis*, named by Mrs. Woodrow Wilson, was launched on December 4, 1918.

This ship has fulfilled every expectation of Messrs. McDonald and Shoolman and has disproved every objection of all engineers. It is 250 feet long by 43 feet beam, and has a carrying capacity of 3,000 tons dead weight. It is lighter than a wooden ship of the same size, took less time to build and is absolutely watertight.

The experiment has proven so successful that the government has built four new yards for the construction of concrete ships, and where formerly they hesitated about the practicability of a 3,000-ton ship they are now building 7,500-ton ships.



HIGH SPEED
BOSS
CONTRACTORS EQUIPMENT

BUILT OF STEEL
Contractors' Equipment
LOW 1919 PRICES

High Speed—High Efficiency Equipment. All Modern Improvements. Steel Construction—Hyatt Roller Bearings—Gas, Steam, or Electric Power.

Mixers for Every Purpose
All Used Sizes. Patented High Speed Mix and Discharge. Pavers, Grouters, Building Mixers. Also Hoists, Pumps, Etc.

Prompt Deliveries
Stocks in all Large Cities. Prices Astonishingly low. "Money Back" Guarantee. Cash or Payments.

The American Cement Machine Co. Inc.
Keokuk Iowa
(THE 300,000 HP ELECTRIC CITY)

Pavers
Mixers
Hoists
Back Fillers
Grouters
Pumps
Material Elevators

Drain Tile Sales Will be Larger Than Ever

The farmer is urged to still greater crop production; not a square foot of land can be left uncultivated. A huge amount of drainage will mark next year's activities; drain tile will be at a premium.

Every concrete products plant should get in shape to handle the biggest spring business in drain tile ever known. Almost every plant is capable of making tile at very little additional outlay. We post you on manufacturing and furnish all equipment.

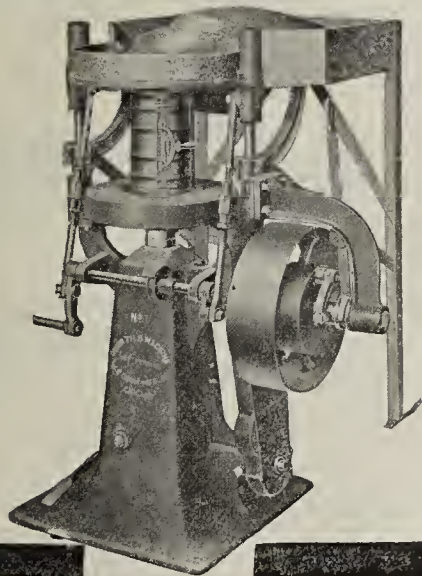
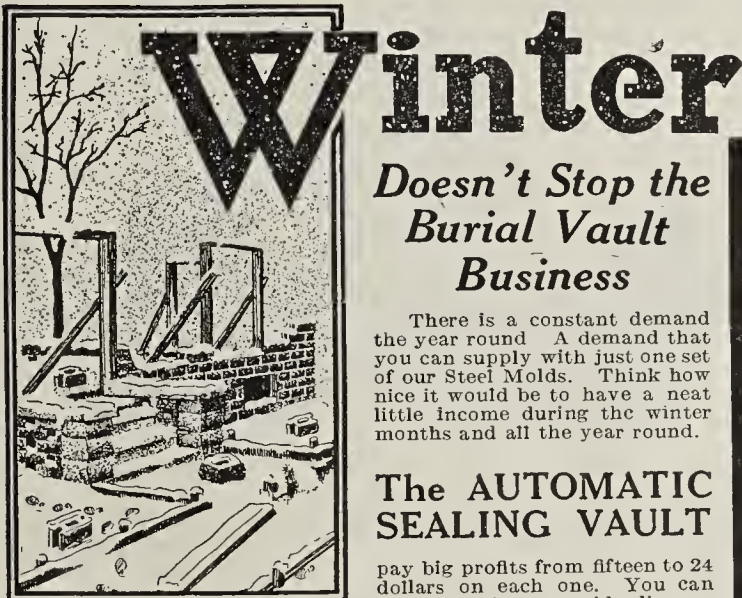
Dunn—the Standard Machine

Ninety per cent of high grade tile is made on the Dunn machine, because it absolutely guarantees a strong, lasting and superior product. Double packing and double troweling are features only of tile that are Dunn-made. Easily better than clay tile, and can be sold in competition with it.

The Dunn machine makes manufacturing easy and highly profitable, and is sold at a lower price than any other machine of its capacity. Write for bulletins on the machine and the business.

W. E. Dunn Mfg. Co.

414 24th Street
HOLLAND, MICH.

Winter

Doesn't Stop the Burial Vault Business

There is a constant demand the year round. A demand that you can supply with just one set of our Steel Molds. Think how nice it would be to have a neat little income during the winter months and all the year round.

The AUTOMATIC SEALING VAULT

pay big profits from fifteen to 24 dollars on each one. You can develop this as a side line or devote all your time to it. Make the dollars come in this winter

by making the AUTOMATIC SEALING VAULT

The First Step is to send for information. We'll furnish full details and particulars. Write Today.

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The Finished Vault



Northwestern Steel Forms

Used and recommended by engineers and contractors. Accepted as standard in every state. Save labor, time and money in construction of culverts, sewers, flumes, drains, tiles, and all such work. Made in standard and special sizes. For complete information, write for Bulletin 29.

Northwestern Steel & Iron Works

Eau Claire, Wis.



BIG PROSPECT—

A record wheat crop is in prospect. From every quarter is coming the call for more storage.

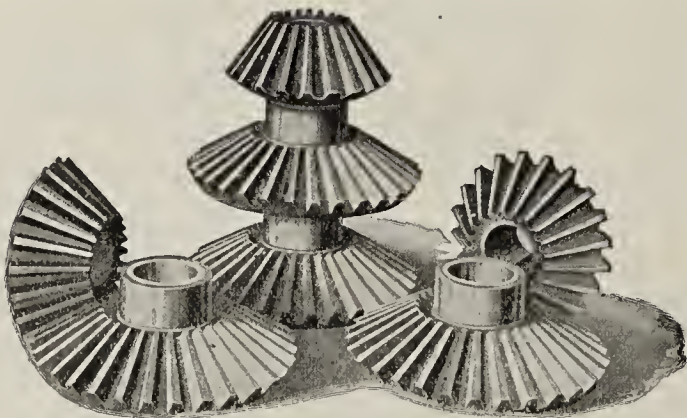
Get ready for a big business in storage, water tank, coal pocket, and silo construction. The POLK SYSTEM machine makes you ready. It is what you want—by far the best and the truly cheapest.

Start your investigation of the prospect and the POLK SYSTEM today. Ask for our latest catalog.

Polk, Genung, Polk Company

706 Fisher Bldg.
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Indiana



Make Your Gear Service a Certainty

Ganschow Bevel Cut Gears—like Ganschow Gears of every kind—are cut with an accuracy and precision which makes smooth, easy, effective working a certainty. They minimize wear and tear and insure long life to the parts. From twenty to forty per cent less power is required to operate

Ganschow Cut Gears

as compared with cast gears, because of evenly-thick and evenly-spaced teeth, and because they are uniformly smooth. Throughout the whole machine the jar and strain are greatly reduced; and this means gear-efficiency from every standpoint.

As specialists in gear work, our splendid facilities enable us to take care of any requirement from the smallest gear up to 12 ft. in diameter—and do it QUICK. Every gear strictly according to specifications and free from defects.

How about YOUR gear requirements?

Wm. Ganschow Company, Chicago, Ill.
1003 W. Washington Street

Henry Heil Chemical Company

210 to 214 South Fourth Street, ST. LOUIS, MO.

We make a specialty of
supplying cement works with

Chemical Apparatus, Chemicals and Reagents

Gilmore's Needles, Cement Moulds, Vicat Apparatus,
Schumann's, LeChatelier's and Jackson's
Specific Gravity Apparatus, Etc.

Pyrometers, Calorimeters
High Grade Goods Only

Satisfaction Guaranteed

SOPER ENGINEERING CO.

ELLIS SOPER, PRESIDENT
CHATTANOOGA, TENN.

Designing, Constructing and Operating Engineers
and Contractors

Cement Plants and Reinforced Concrete Bridges a Specialty

WEBER REINFORCED CONCRETE CHIMNEYS

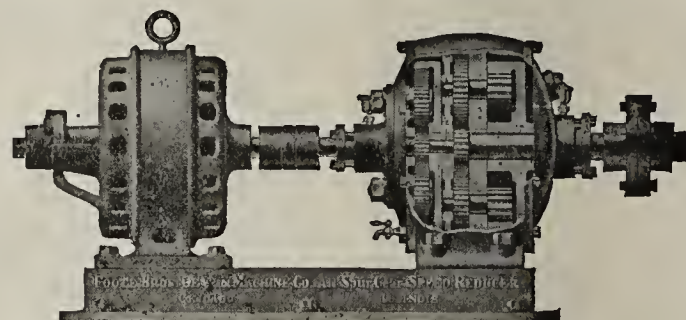
Coniform and Cylindrical Types Hundreds In Use

—WEBER CONIFORM CHIMNEY—

The Weber Chimney Company

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CHICAGO, ILL.



SPUR GEAR SPEED REDUCERS

Note they are dust proof, compact, made in any horse power or reduction. Just what is needed on conveyors, elevators and reduction of speed anywhere. We manufacture cut gears. Send for catalogue.

FOOTE BROS. GEAR & M. CO.

203 North Curtis St., Chicago

STEEL BARS

FOR

Reinforcing Concrete

OUR
SERVICE
ESTIMATING
SETTING AND
BENDING DETAILS
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PLAIN AND DEFORMED
ROUNDS AND SQUARES

Shipments from
Stock and Mill
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Cement and Hydrated Lime Plants a Specialty

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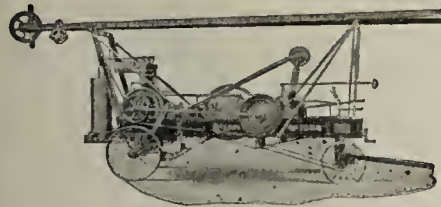
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PURIFICATION SYSTEMS
SOFTENING & FILTRATION
FOR BOILER FEED AND
ALL INDUSTRIAL USES

WM. B. SCAIFE & SONS CO. PITTSBURGH, PA.

A Big Blast-Hole Drill That's Reliable



**The Cyclone
No. 14**

Heavy, solidly braced frame—Sill timbers 4" x 14". All machinery placed directly on the main sills protecting it against strains and preventing top heaviness. **Eighty per cent (80%) of the castings are cast steel—not cast iron.** The Cyclone No. 14 is the only Blast-Hole drill so built. Furnished in Steam, Gasoline, Compressed Air or Electric Power; traction or non-traction.

The Sanderson Cyclone Drill Co., Orrville, Ohio
Eastern and Export Office, 50 Church St., New York, N. Y.

PULVERIZED COAL EQUIPMENT

AERO PULVERIZER CO., 120 BROADWAY, N.Y.

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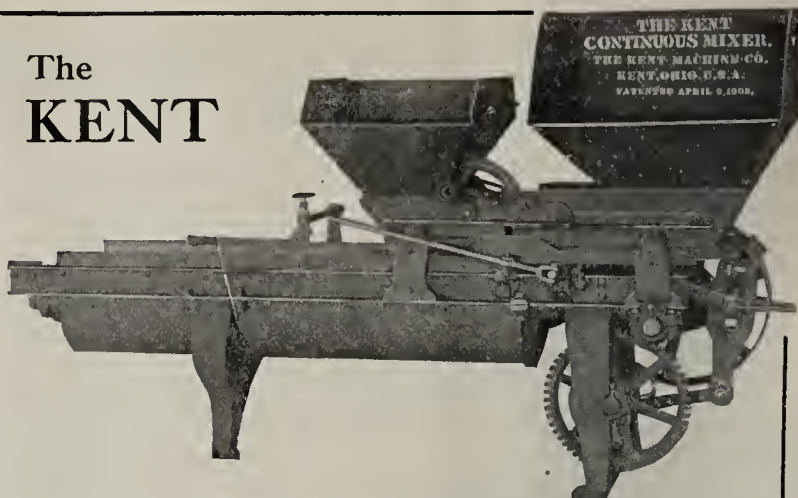
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The
KENT



This is the Kent Continuous Mixer, Stationary Type. We manufacture Portable Machines also.

Write for information covering your peculiar requirements.

We have the machine you need.

KENT MACHINE CO.

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Kent, Ohio

Absolutely Fireproof **HOTEL CHELSEA**

West Twenty-third St., at Seventh Av.

NEW YORK CITY

European Plan

500 ROOMS 400 BATHS

Room, with adjoining bath,
\$1.00 and \$1.50

Suites, parlor, bedroom and bath,
\$3.00 and upward

Club Breakfast, 30c up

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Cafe attached

TO REACH HOTEL CHELSEA

From Pennsylvania Station, 7th Avenue car south to 23d Street;

Grand Central, 4th Avenue car south to 23d Street;
Lackawanna, Erie, Reading, Baltimore and Ohio,
Jersey Central and Lehigh Valley R. R. Stations,
take 23d Street crosstown car east to Hotel Chelsea.

Principal Steamship Piers, Foot West 23d Street,
take 23d Street crosstown car.

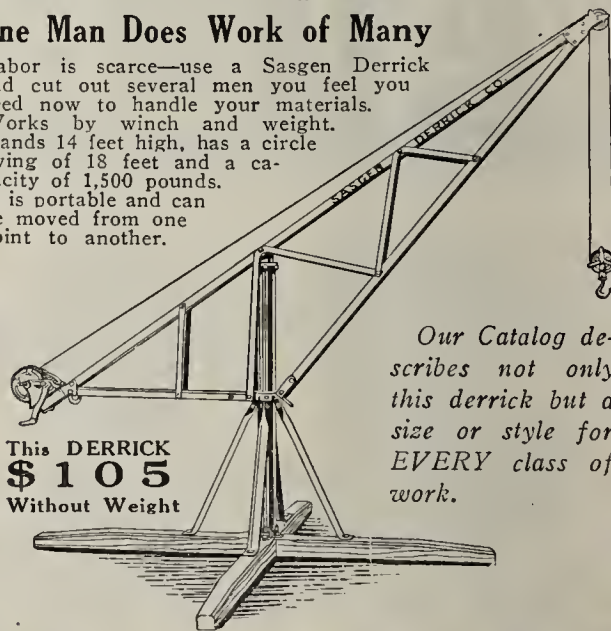
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Load and Unload With a Sasgen Portable Derrick

The Sasgen Circle Swing Counterweight Derrick cuts costs, labor and time loading or unloading material from cars or wagons.

One Man Does Work of Many

Labor is scarce—use a Sasgen Derrick and cut out several men you feel you need now to handle your materials. Works by winch and weight. Stands 14 feet high, has a circle swing of 18 feet and a capacity of 1,500 pounds. It is portable and can be moved from one point to another.



This DERRICK
\$105
Without Weight

Our Catalog describes not only this derrick but a size or style for EVERY class of work.

Sasgen Derrick Co., 3117 W. Grand Ave., Chicago

CALDWELL HELICOID

HELICOID Screw Conveyor is heavier, stronger and better made than any other. Requires fewer repairs—no lapped and riveted joints to come apart—flight all one piece. Special hangers, bearings and boxes for cement work. If you have anything to do with the manufacture of cement, you should write for our Catalogue.

Elevating, Conveying and Power Transmitting Machinery.

H. W. CALDWELL & SON CO.

17th Street and Western Ave., CHICAGO

NEW YORK, Fulton Bldg., Hudson Terminal, 50 Church St.

DALLAS, TEXAS, 711 Main St.

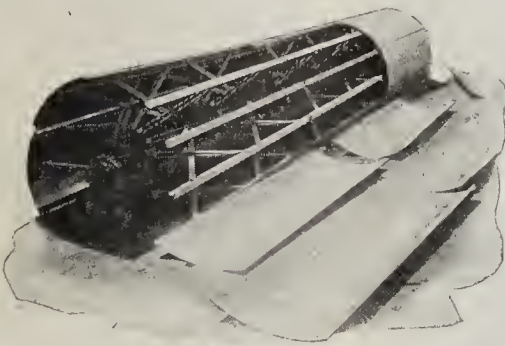
'HIPCO' Culvert Form

Adjustable to 39 different diameters, of any and all lengths. Easily portable, quickly set in place, easily withdrawn, nests in small storage space, cuts concrete culvert costs wherever used. Roller bearings—nothing complicated.

Write for catalog and prices.

Highway Iron Products Co.

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GRANOLITHIC

A superior, colorless,
Liquid Cement Hardener

GRANOLITHIC makes cement floors
Wear Proof—Dust Proof and Water Proof.

The dust that is so injurious to merchandise, machine bearings and motors is eliminated. The cost of treating cement with GRANOLITHIC is trifling compared to the economies effected.

Unsolicited testimonials tell the story. Write for full particulars today.

GRANOLITHIC COMPANY, Inc.

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Midway

LIQUID
CEMENT
FLOOR HARDENER

FOR SALE:

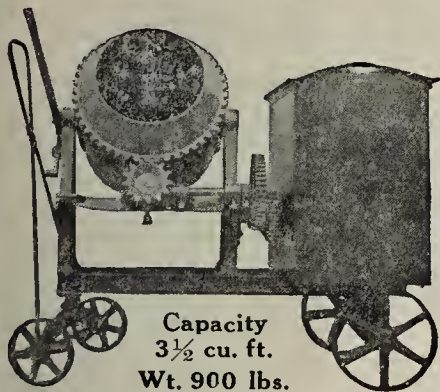
Crushed Stone plant near Blue Springs and Wymore, Nebr., on Union Pacific and C. B. & Q. railroads. The quarry farthest west in Nebraska or Kansas. Forty feet of stone. Light stripping. Large territory. Good prospects. Sixty-seven feet of shale under quarry bed. Ideal location for Portland cement or fancy brick plant.

G. H. DAVIS

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Republic Mixers



Capacity
3½ cu. ft.
Wt. 900 lbs.

Before you buy a mixer, look over the Republic line. The prices are reasonable, the machines are ready to ship and the terms may be arranged to accommodate you. Line includes tilting and non-tilting types from 3½ to 10 cubic feet capacity, low charging, power loaders, etc.

Power Mixer \$160.00

This mixer is complete with all-steel construction, including truck, engine and housing. A bargain!

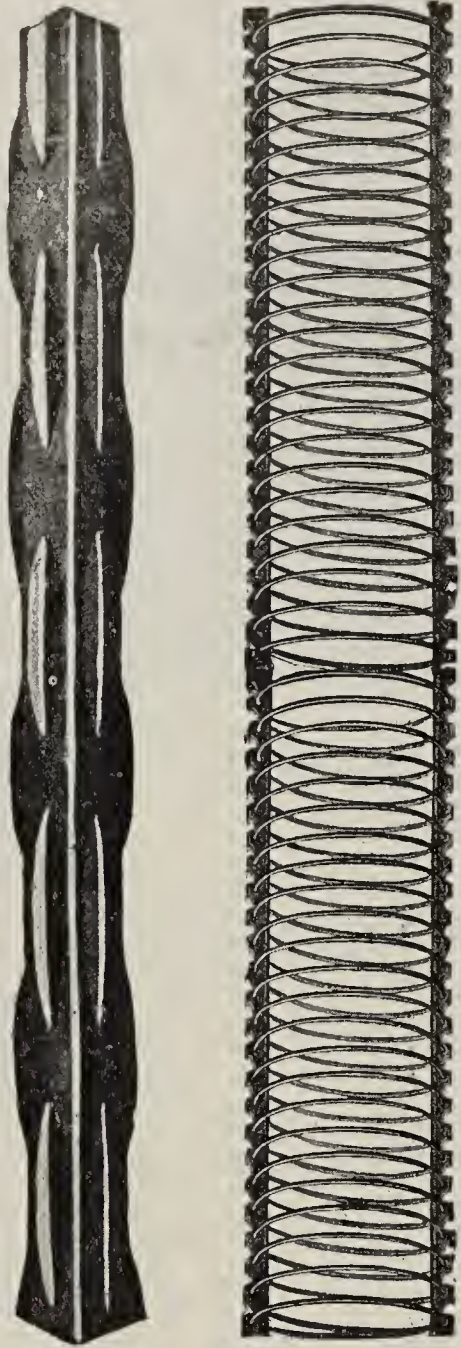
Hand or Belt Mixer \$55.00

Write for the big Republic Mixer catalog.

REPUBLIC IRON WORKS, Box 454, TECUMSEH, MICH.

will save
you money





STEEL BARS

AND

SPIRALS

FOR

REINFORCED
CONCRETE
CONSTRUCTION

“Bars on the Job Ready for Your Men”

Delay, caused by the failure to have your reinforcing material on the job not only throws out your calculations but also the schedule of every other contractor on the job.

You can save the loss of much time and money by specifying Havemeyer Bars for your reinforced concrete work.

Their prompt service insures your having bars on the ground when the men go to work.

HAVEMEYER BAR

Service insures direct shipments of reinforcing steel from our Chicago warehouse, which is located within easy teaming distance of the loop and makes delivery when material is needed.

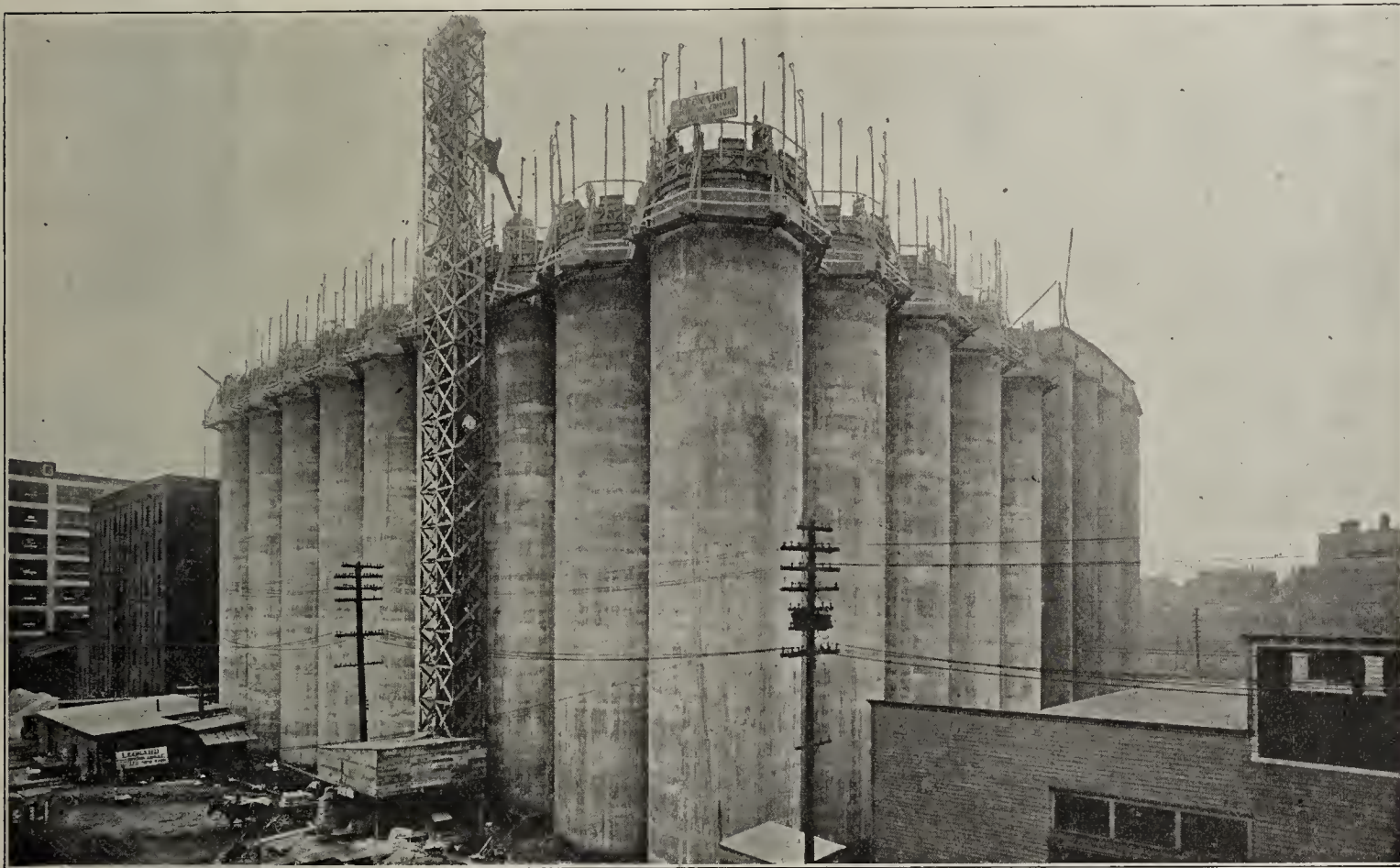
Havemeyer Products, Bar-Tys, Bar-Spacers, Ty-Chairs, Beam-Saddles, Etc., keep the steel in its right place while the concrete is being poured.

Try Our Service

CONCRETE STEEL CO.
MONADNOCK BLDG. CHICAGO

INVESTIGATION AND EXPERIENCE ARE PROVING THE RELIABILITY OF HYDRATED LIME

FOR WATER PROOFING AND TO FACILITATE POURING CONCRETE



In these 51 concrete storage tanks, recently erected in Cedar Rapids, Iowa, by the Quaker Oats Co., there are approximately 12,500 cubic yards of concrete—1-2-4 mix. The walls are perfect cylinders, with no lips or bulged surfaces.

Hydrated lime was used for waterproofing and also to facilitate pouring the concrete and lifting the forms, owing to its lubricating properties. In mixing, 25 pounds of hydrated lime was put into each batch, which made the percentage of lime to cement a little over 8% by weight. The mixers used were of such size that three bags of cement could be used in each batch.

Considerable credit is given by the Leonard Construction Co. of Chicago to the lime. The statement is made that the lime gave the exterior surface a white and uniform appearance, and that the surface needed no subsequent coating. There were no joints where the concrete stuck to the forms and "lifted," as it does in many cases where the concrete is not of uniform mixture.

Write any of the following competing manufacturers of Hydrated Lime for complete information about Hydrated Lime in Concrete

Port Byron Lime Assn.,
Port Byron, Ill.

Lee Lime Co., Lee, Mass.
Glencoe Lime & Cement Co.,
St. Louis, Mo.

Hunkins-Willis Lime &
Cement Co., St. Louis, Mo.

Riverton Lime Co.,
Riverton, Va.

Ste Genevieve Lime Co.,
St. Louis, Mo.

Palmer Lime & Cement Co.,
103 Park Ave., New York, N. Y.

Rockland & Rockport Lime Co.,
New York—Rockland, Maine—Boston

The A. & C. Lime Co.,
Canton, Ohio

O. C. Barber Allied Industries John D. Owens & Son Co.,
Canton, Ohio Owens, Ohio.

Kelley Island Lime & Trans-
port Co., Cleveland, Ohio

National Lime & Stone Co.,
Carey, Ohio

Ohio Hydrate & Supply Co.,
Woodville, Ohio

Woodville Lime Products Co.,
Toledo, Ohio

erion Lime & Stone Co.,
Norristown, Pa.

Vermarco Lime Co.,
West Rutland, Vt.

Union Lime Co., Milwaukee, Wis.

Pebbles for your tube mills

Superior to Flint Pebbles and Will Not Break

Tested by Engineers and Chemists
Shipments Promptly Made
Satisfaction Guaranteed

Peruvian Tube Mill Pebble Co.
152 Colmena Ave. **LIMA, PERU**

BALLS

Forged steel balls of special analysis steel from 2" to 15" in diam. carried in stock. Can't be excelled.

BALL MILL PLATES	GRIFFIN MILL CROSSHEADS
CRUSHER SHAFTS	PIPE FLANGES
GRIFFIN MILL SHAFTS	for High Pressure Work
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Hammer and Hydraulic Press Forgings of all kinds

We make quick service a feature of our business

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52nd AND GRAY'S AVENUE, PHILADELPHIA, PA

IMMEDIATE DELIVERY

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ROUND—SQUARE—FLAT—SQUARE TWISTED

STEEL BARS

for CONCRETE REINFORCING

We can meet your Reinforcing Steel Requirements. This means not only quick shipment from the mills but co-operative service for rapid transportation. If you want to know just what your exact cost will be, send us the Blue Prints and we will give you a lump sum bid on all the steel sheared to lengths, bent to specifications and delivered to the job.

Our Engineering Department is at your service.

The FRANKLIN STEEL WORKS

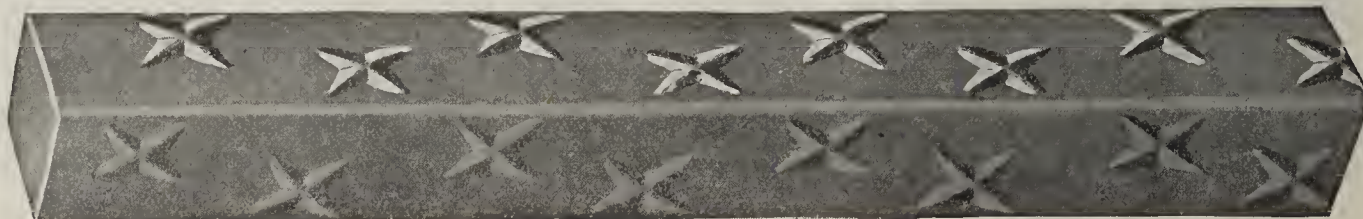
FRANKLIN, PENNA.

Cleveland, 1320 Rockefeller Bldg.	
Boston, - 12 Pearl Street	
Philadelphia, 2215 Race Street	
New York, - 30 Church Street	
Chicago, - 332 So. Michigan Blvd.	
Buffalo, - Erie County Bank Bldg.	
Pittsburgh, Oliver Bldg.	

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SERVICE

Inland Deformed Bars



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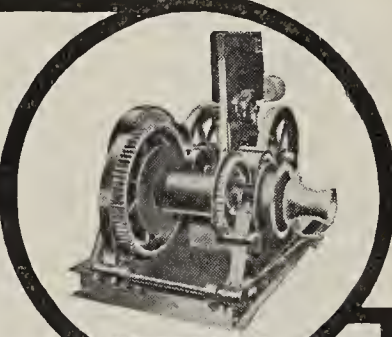
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1—12x12x16 Ingersoll, straight line, steam driven, capacity about 300' at 80 to 100 lbs.....	600
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1—9x14 Davenport 36 in. gauge saddle tank.....	1,400
1—19x24 Baldwin, 10-wheeler, 60 tons, just rebuilt.....	8,000
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1—17x24 6-wheel switcher.....	8,000
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- 1—18x24 cylinder, Brooks 6-wheel switcher with tender. Weight 50 tons on drivers; 44-in. wheel centers; 11 ft. 3 in. wheel base; steam pressure 160 lb.
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- 1—18x24 cylinder, 10-wheel locomotive, weighing 55 ton, with 42 ton on drivers; built by American Locomotive Co., in 1907; steam pressure, 170 lb.; rigid wheel base, 10 ft. 2 in.; wheel centers, 44 in. in diameter. Most modern locomotive, receiving general overhauling. Suitable for switching if desired.
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- 10—36-in. gage, 10x16 and 9x14 Davenport American and Vulcan saddle tank locomotives.
- 1—7x12 cylinder, 24-in. gage Davenport saddle tank locomotive. Weight 9 tons.

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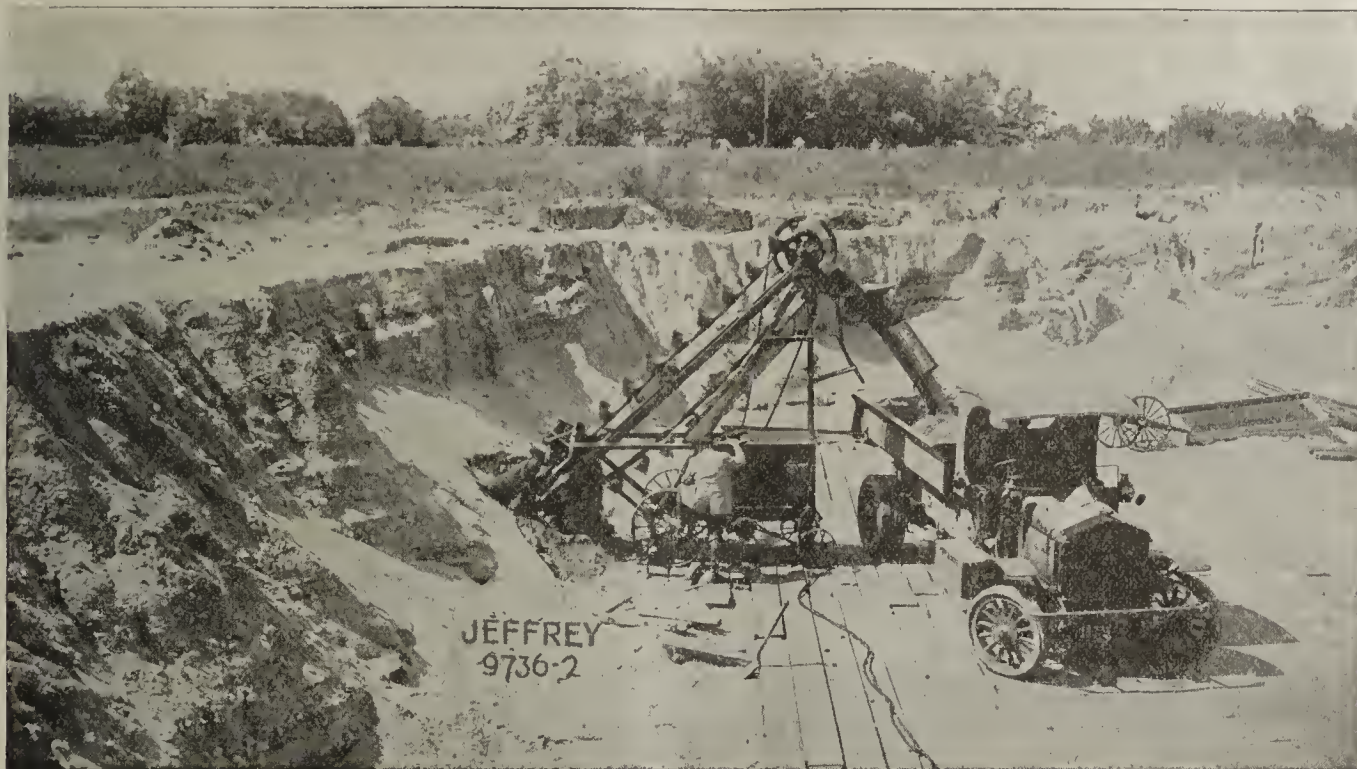
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CEMENT AND ENGINEERING NEWS

with which Gravel & Stone Magazine is incorporated

(PUBLISHED MONTHLY)

William Seafert, *Publisher and Editor*

J. F. Waldron, *Advertising Manager*

R. M. McCully, *Business Manager*

Office—672 Transportation Building, Chicago

Telephone, Harrison 5397

Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, \$1.00 per year; all
other countries, \$1.50 per year.
Single Copies 20c.

DISCONTINUANCES—The greater part of our subscribers prefer NOT to have their subscriptions interrupted, in case they fail to remit promptly for renewal. It is therefore assumed, unless notification is given to the contrary, that the subscriber wishes to continue taking our paper. Therefore CEMENT & ENGINEERING NEWS will be sent until we are notified to discontinue—Such notice should be sent when the subscription expires.

Advertising copy or changes in ads. must be in this office by the 25th of each month, as hereafter our magazine will appear on the 5th of the following month

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NEW WASHING AND SIZING PLANT OF
THE TECUMSEH GRAVEL CO.,
TECUMSEH, MICH.

—Where—

A 100 H.P. PRIMM OIL ENGINE

Furnishes power for the screens, bucket
elevator and 5 in. centrifugal pump

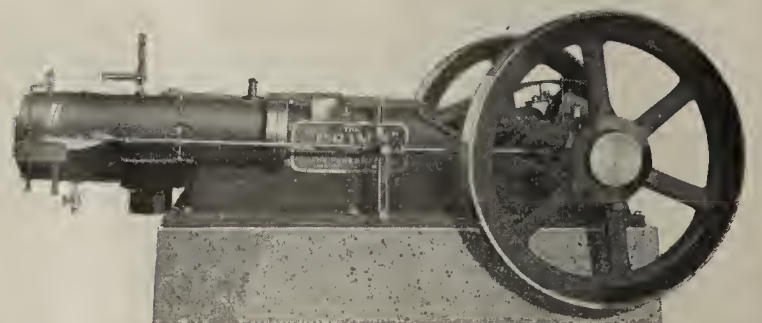
Starts in less time and more easily than a
Steam Engine after steam is made.

**NO spark—valves—carburetor or
Magneto.**

**Burns crude oil or any of its by-products
Saving approximately 50%
depending on its use**

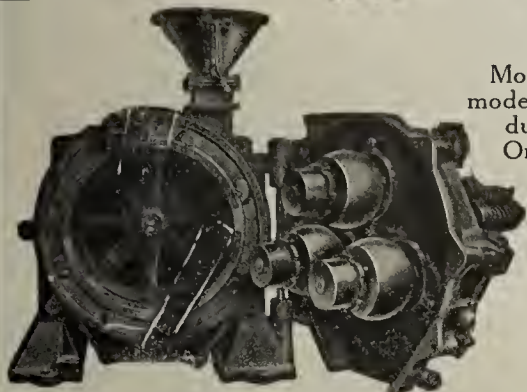
Cross Head insures long life of cylinder
All working parts properly lubricated by
Splash system lubrication in crank case

The Power Mfg. Co.
13 Cheney Ave. MARION, OHIO.



STURTEVANT MILL CO.

HARRISON SQUARE - - BOSTON, MASS.



Ring-Roll Pulverizer

RING-ROLL PULVERIZERS

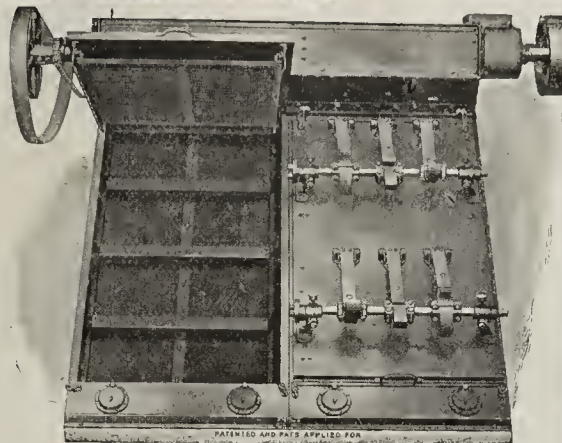
Most durable and efficient grinder for hard and moderately hard rock or ore. Used for the reduction of Cement- Clinker, Limestone, Quartz, Ores, Granite, Trap, Phosphate, Coal, etc., etc. Hundreds in use.

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NEWAYGO SUPER-SCREENS

Inclined Vibrating Screen, Unit Construction. Screens everything screenable that is reasonably dry. Produces from $\frac{1}{4}$ mesh to 180 mesh.

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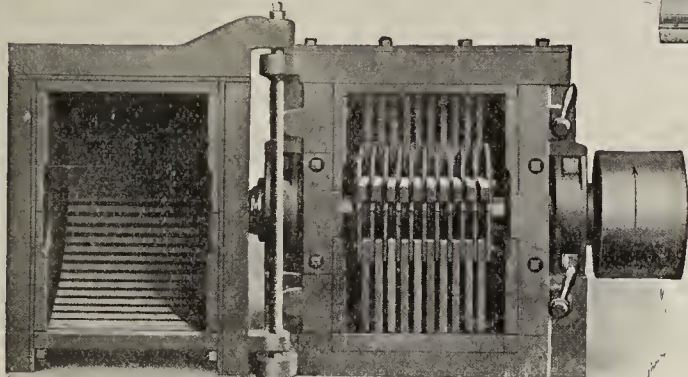


Newaygo Super-Screen

SWING-SLEDGE MILLS

The greatest producers known on Limestone, Lime, Shells, Chemicals, Talc, Clay, Chalk, Bark, Rosin, Sulphur, Coal, Salt, and many other moderately hard and soft materials. High Speed Pulverizers, crushing by a series of blows delivered at high speed against the material fed into the machine.

Send for Circular 84



Swing-Sledge Mill

WE MAKE THE
LARGEST COMPLETE
LINE OF
CRUSHING, GRINDING,
SCREENING, WEIGHING,
SACKING, ELEVATING
AND MIXING MACHINERY
IN THE WORLD

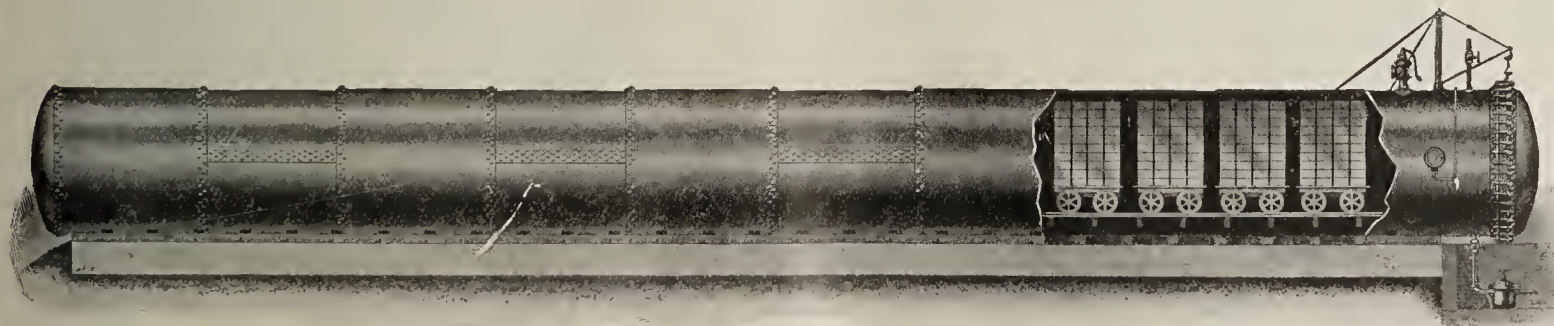
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Sand Lime Brick Machinery

Our complete line of Sand Lime Brick Machinery makes it possible to secure just that machinery which is required to make your plant a success. We favor no particular type of machinery but are guided by the needs of the customer. Our wet and dry grinding mills have transformed a number of unsuccessful plants into dividend producers, while our Presses, Mixers, Hardening Cylinders and other equipment are of equal quality. We can exactly meet the demands of any manufacturer with a quality of machinery which will operate at a profit with a minimum amount of attention and expense.

Correspondence solicited

The American Clay Machinery Co.
WILLOUGHBY, OHIO





**These Gears Look Alike.
Can you tell the difference?**

You could see the difference pretty quickly if you had both at work on a machine
One of them is made of

STROH STEEL PROCESS

The other is—just steel. The difference is in the way they wear. The work they do. "Stroh" Gears and Pinions will so far outwear those made of any other material that comparative statements are almost incredible. And breakage in "Stroh" Process steel is unknown.

HERE IS A WAY TO SAVE MONEY

Write us and tell us what machinery you want Gears and Pinions for and we will prove to you that "Stroh" Gears and Pinions will save you money. Write us now while you think of it.

Stroh Steel Hardening Process Co.
PITTSBURGH



This belt is built to meet just such wearing con- ditions as you have in your cement plant

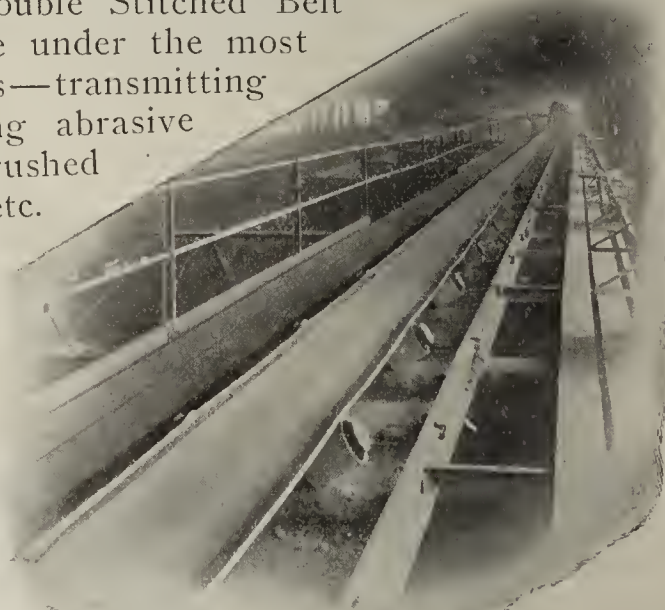
In mines and mills the world over you will find Black Giant Double Stitched Belt giving record service under the most severe conditions—transmitting power and conveying abrasive materials such as crushed stone, sand, gravel, etc.

Two cement companies alone bought during 1917 over Fifty Thousand Dollars' worth of Black Giant Double Stitched Belt.

We would like an opportunity to demonstrate in your mill that this belt—because of its special construction and the compound with which it is treated—will give you better service.

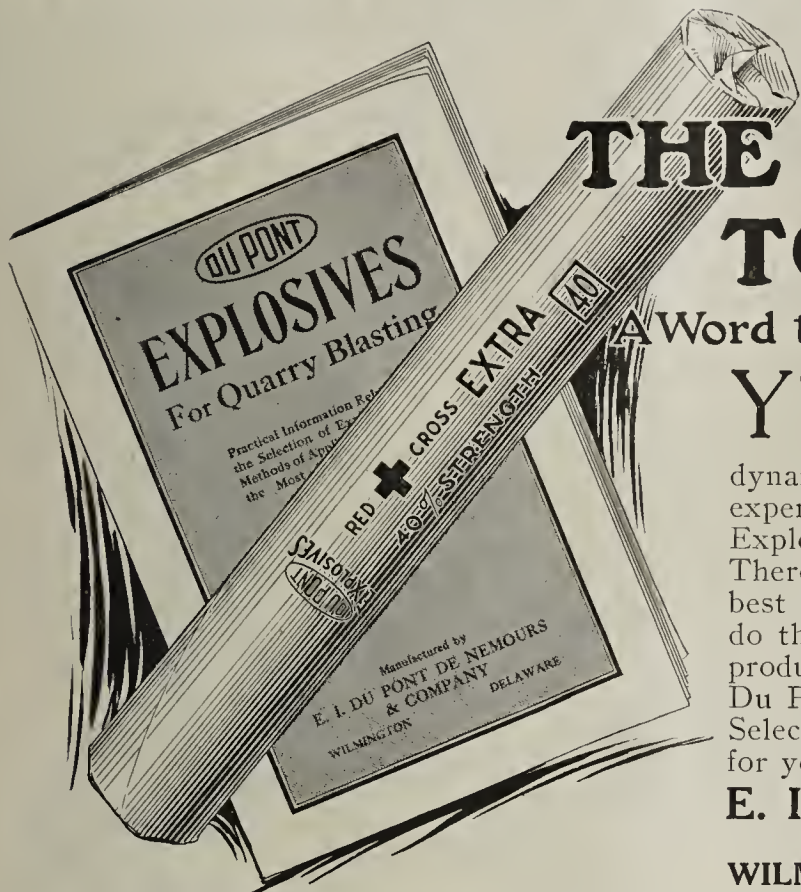
McILROY BELTING & HOSE CO.

Hammond, Indiana



Black Giant Runs True and Even—No Spillage.

DU PONT AMERICAN INDUSTRIES



THE STICK TO STICK TO

A Word to the New Quarry Boss

YOUR predecessor used Du Pont Dynamite because he knew he could depend upon its satisfactory performance. Other dynamites might accomplish as much, but the experienced blaster realized that Du Pont Explosives would give satisfaction **every** time. Therefore, in your new responsibilities it is best to "let well enough alone"—let Du Pont do the experimenting. If it were possible to produce better explosives, rest assured that Du Pont would do it.

Select the proper grade of Du Pont Explosive for your work and then **STICK TO IT.**

E. I. du Pont de Nemours & Co.

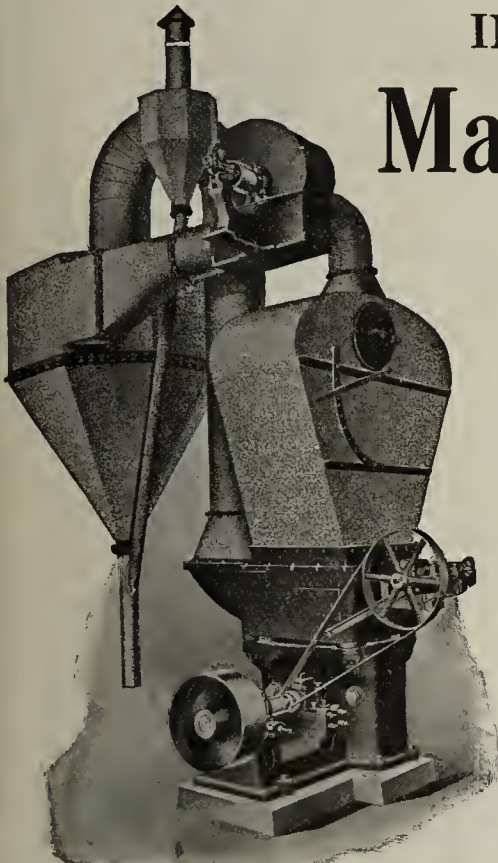
Powder Makers Since 1802

WILMINGTON,

DEL.

DU PONT

Complete Grinding IN ONE Machine



In successful use
grinding
Cement, Clinker,
Limestone, Coal

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OF
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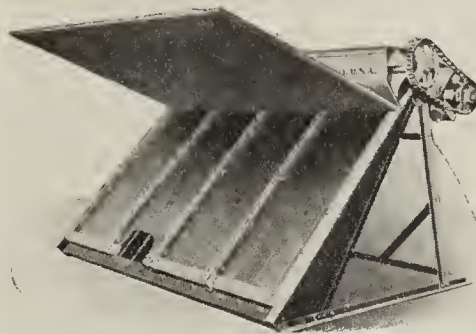
NO DUST

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THE BONNOT CO.
CANTON, OHIO

National Screen Separator

THE LEADING SCREEN IN



**Efficiency
Durability
Simplicity**

Write for Descriptive
Literature to

National Engineering Co.
549 W. Washington Blvd.
Chicago, Ill.

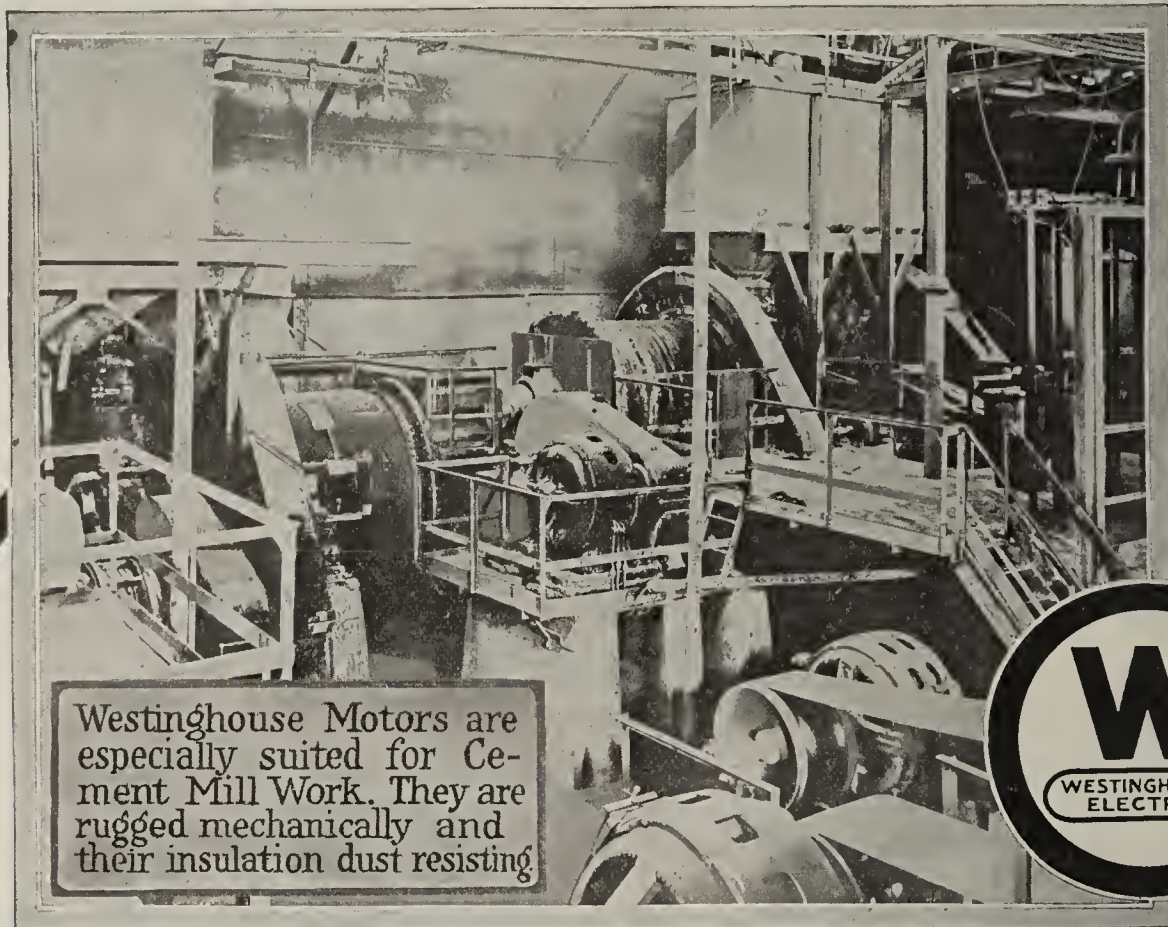
FROGS SWITCHES CROSSINGS

Portable and Industrial Track, Tie
Plates, Switch Stands, Rail Braces,
etc. Can make prompt shipments.

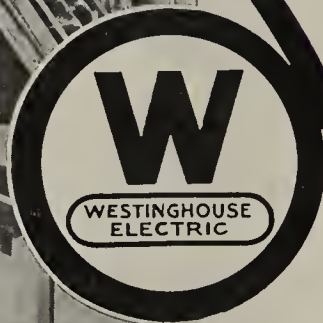
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— Established 1906 —

THE CINCINNATI FROG & SWITCH CO.
Cincinnati, Ohio

Meet New Demands with New Methods



Westinghouse Motors are especially suited for Cement Mill Work. They are rugged mechanically and their insulation dust resisting



Now that the big job across the water is completed, and delayed building activity will be resumed, will you be in a position to reap the fullest benefit from new trade conditions? Deferred plans for dams, irrigation projects and roads may now be carried to completion, and it is fair to assume that cement will enjoy an unprecedented demand.

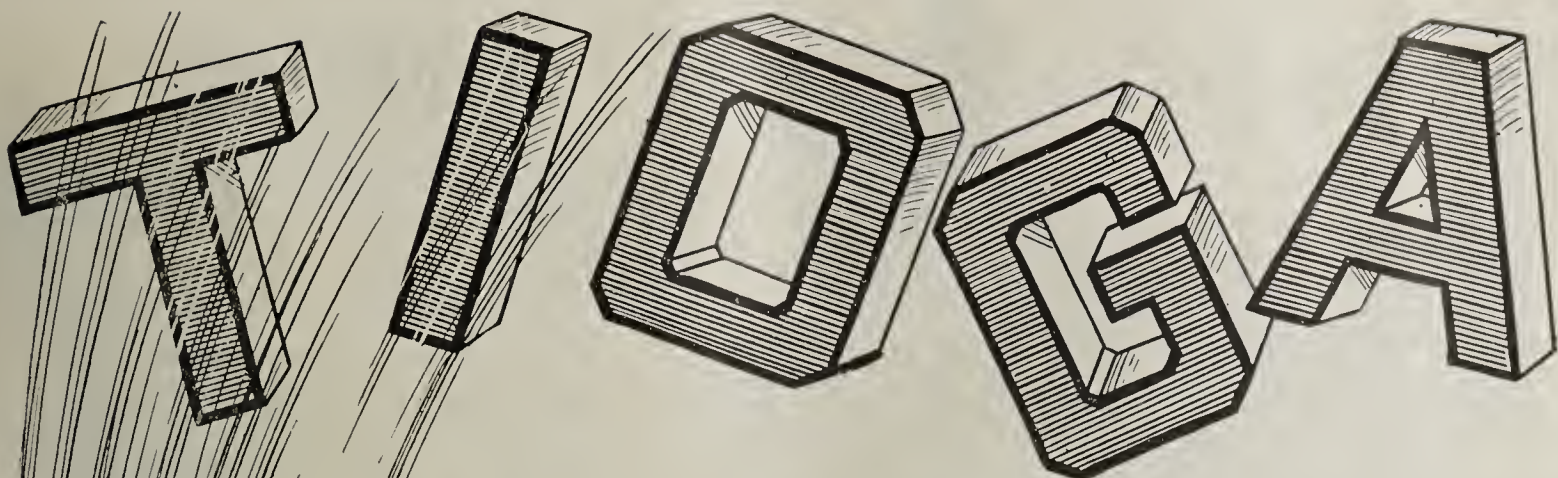
How much of this demand you share in will be largely dependent on the capacity of your mill—which can be speeded up and made increasingly productive with

Westinghouse Electric Drive

Many cement manufacturers who have already electrified with Westinghouse Equipment, will be prepared to meet the heaviest demands on short notice. Write our nearest office. The service of Westinghouse engineers are at your disposal.

Westinghouse Electric & Mfg. Co.,
East Pittsburgh, Pa.

Westinghouse



TIOGA

Cement Manufacturers!

*If it's Forgings
—Tell TIOGA*

Now is the time to "tune up" your mill equipment and TIOGA service is on the job.

Forged steel balls of special analysis steel from 2" to 15" in diameter. Quantity carried in stock at all times.

Ball Mill Plates
Crusher Shafts
Griffin Mill Shafts
Griffin Mill Convex Seats

Griffin Mill Cross Heads
Pipe Flanges for High Pressure Work
Steam Shovels, Truck and Car Axles
Hammer and Hydraulic Press

Forgings of all kinds

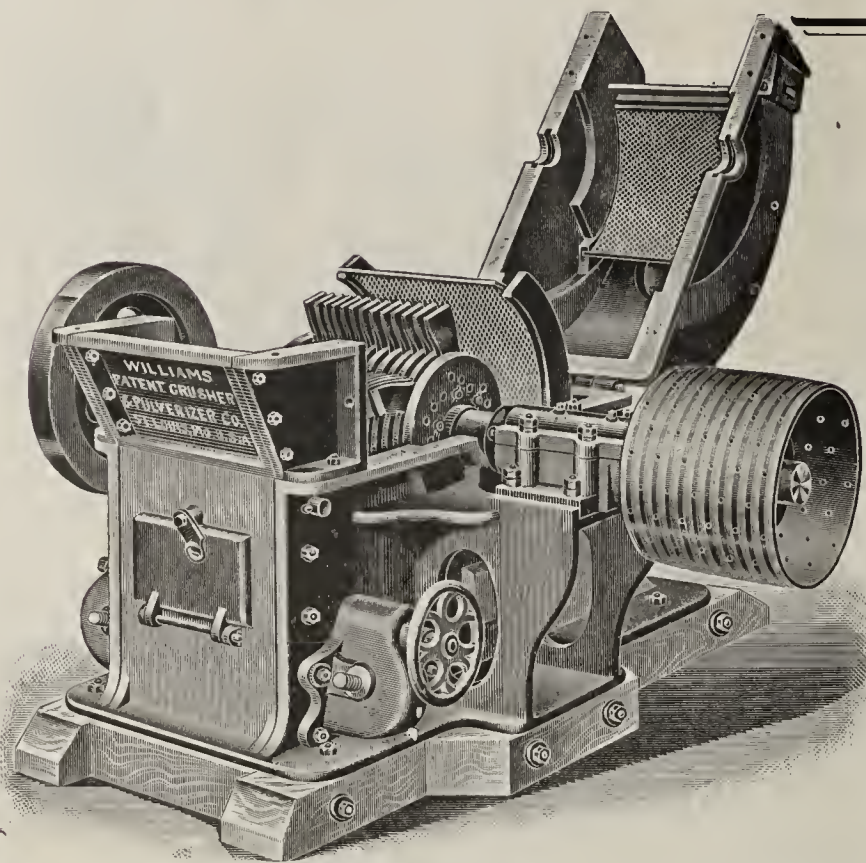
Tioga Steel & Iron Company

52nd & Gray's Avenue, Philadelphia, Pa.

Subsidiary of
TAYLOR WHARTON IRON & STEEL CO., High Bridge, N. J.
Other Subsidiaries
PHILADELPHIA ROLL & MACHINE CO. Philadelphia, Pa. WM. WHARTON, Jr., & COMPANY, Inc. Easton, Pa.

Forged Steel BALLS





WILLIAMS

LIMESTONE GRINDERS

Take 2 in. to 3 in. dry stone and in one operation, without outside screens or separators will produce 95% through 20-mesh material.

CAPACITIES RANGE FROM 1/4 TO 30 TONS PER HOUR

Over 5,000 Williams Mills in Daily Operation.

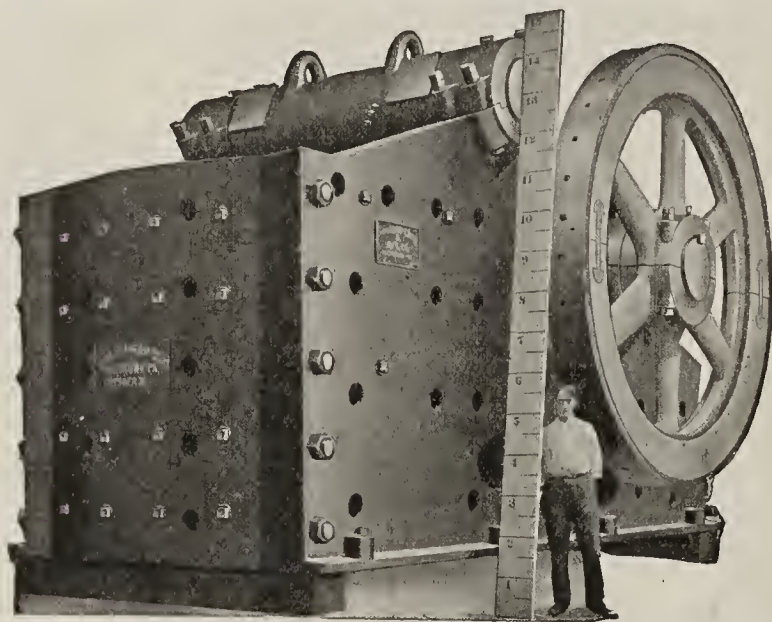
There is undoubtedly room in your plant for one of these machines, which, in the last twenty-two years have proven that they are money savers, can be depended on, and really have merit. If further information is desired, Write for Bulletin No. 17, which is brim full.

THE WILLIAMS PATENT CRUSHER & PULVERIZER COMPANY

General Sales Dept.—37 West Van Buren Street
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SAN FRANCISCO



Traylor 60"x86" All Steel Jaw Crusher

TRAYLOR JAW CRUSHER

Are Built in All Sizes from 7"x10" to 66"x86"

The 66"x86" is the largest crusher built.

All Traylor Jaw Crushers have cast steel water cooler pitmans.

Extra size pitman and swing jaw shafts of finest hammered steel.

Chrome steel toggle seats.

Manganese steel or chilled iron jaw plates.

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MAIN OFFICE AND WORKS: ALLENTOWN, PA., U. S. A.

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TRAYLOR BUILT

MACHINERY

A CRUSHER FOR EVERY PURPOSE

We Make

In addition to JAW CRUSHERS illustrated

The Traylor Gyratory Crusher

The last word in Gyratorys.

The Traylor Crushing Rolls

They eliminate the personal equation in automatically preventing tire corrugations.

The Traylor Tube Mills

Long or short for wet or dry grinding. Have water cooled bearings of extra size. Positive automatic feed that assures maximum tonnage for minimum horse power.

The Traylor Ball Tube Mill

For reducing lumps to fines in one step.

**"THE ULTIMATE
CRUSHING EQUIPMENT"**

A MODERN PLANT EQUIPPED WITH A MODERN CRUSHER



THE size and capacity of the large sand and gravel crushing and washing plant of the Akron Gravel and Stone Co., Akron, Ohio, illustrated above, exceed any other land operated plant so far constructed. The daily 10-hour capacity is 100 cars of crushed and washed material. This modern, electrically operated plant is equipped with a 48-inch Symons Disc Crusher.

Equip **your** plant with a Symons Disc Crusher. It will increase your output, lower your cost and deliver a more uniform material. The Symons Crusher is unexcelled for secondary crushing or to replace Gyratory crushers up to No. 7 1/2. It is also economical in plants where the feed is not over 6 1/2 for use as an initial breaker.

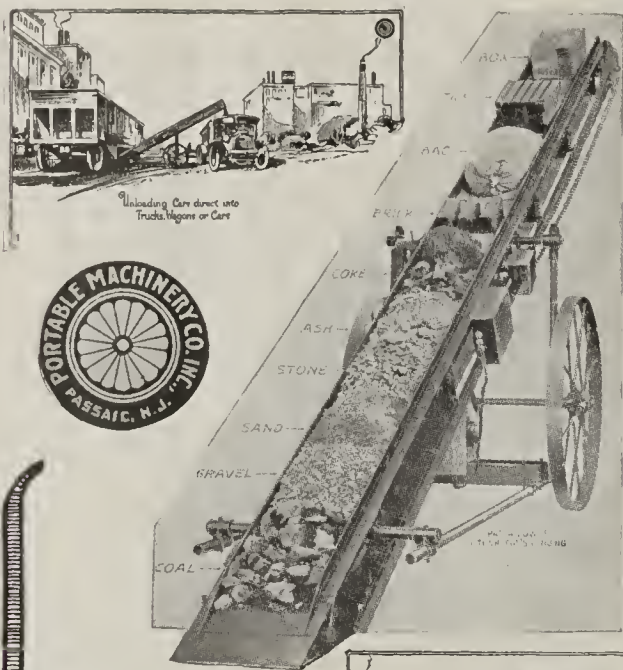
Records made by the Symons Disc Crusher in plants of large gravel producers attest their superiority for low maintenance and operating expense. They are made in four sizes.

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Manufactured and Sold only by

CHALMERS & WILLIAMS

CHICAGO HEIGHTS, ILLINOIS



The Scoop Conveyor

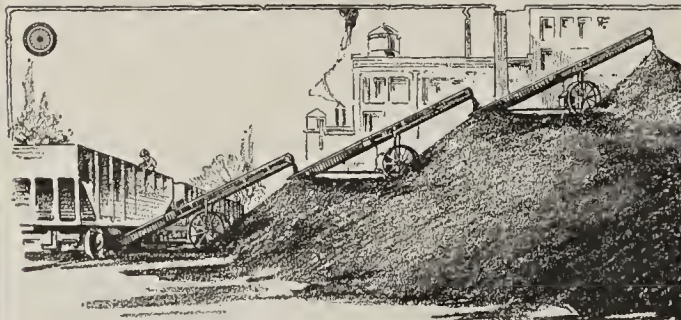
OVER ONE THOUSAND
USERS FIND IT AN INDIS-
PENSABLE SAVER OF
TIME, LABOR AND MONEY

For rapid, clean and economic loading and unloading of cars, stacking coal, sand, ashes, and other loose material, as well as handling boxes, bags, crates and bulky packages of all kinds.

One man and the Scoop Conveyor can do the work for which you now need from 6 to 12 men. Would that help the labor question any for you?

Ask for our literature

Portable Machinery Co., Inc.
Passaic, N. J.



Unloading Cars with one, two, three or more
Scoop Conveyors



TRADE **SAWYER** MARK
Registered

Stitched Canvas Belting

For thirty years "SAWYER" has been a swear-by-word among gravel, stone and cement men.

We recommend it for the particular service required in sand, gravel, crushed stone and cement plants because of the satisfactory results it has always given on this class of work.

SAWYER spells SATISFACTION. It is backed by the world's largest rubber manufacturer.

United States Rubber Company

Mechanical Goods Division



FOR MOST EFFICIENT FINE GRINDING **CONCAVEX**



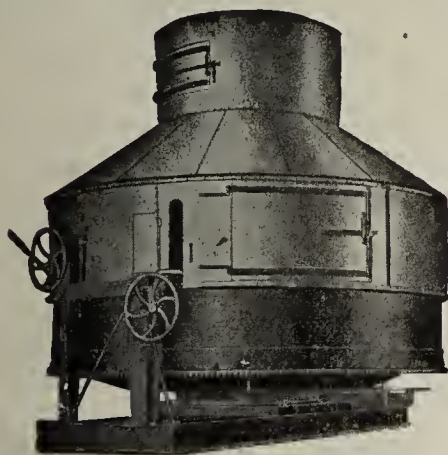
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ALLIS-CHALMERS

Milwaukee, Wis. U.S.A.

Hydrating Plants Equipped With The **CLYDE LIME HYDRATOR**

Are an Assured Success



Clyde Hydrator with Hood
"The common sense way"

The modern Hydrating Plant of the Clinchfield Portland Cement Co., at Kingsport, Tenn., illustrated and described in the February, 1919, issue of Cement & Engineering News, is equipped with the Clyde Hydrator.

This up-to-date and successful Hydrating Plant was placed in operation last summer. It was built and designed by Richard K. Meade & Co., Engineers, Baltimore, Md.

The Clyde Hydrator has become standard equipment. It always turns out a uniform product.

The Clyde makes perfect hydrate of either high calcium or dolomite lime. Low in first cost, simple to install, economical to operate.

H. Miscampbell :: Duluth, Minn.

Patentee and Sole Manufacturer

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Experience The Greatest Builder

Honest manufacturing methods and carefully selected materials, alone will not make road building Machinery. It takes experience—experience in dealing with the most widely diversified problems. Experience that has proved what part or parts are subjected to the greatest strain.

The best materials and nearly a half-century of experience is the combination that has made

Austin-Western Machinery

famous the world over as a "Super-Dependable" line.

The following Austin-Western machines are giving profitable service in practically all parts of the world.

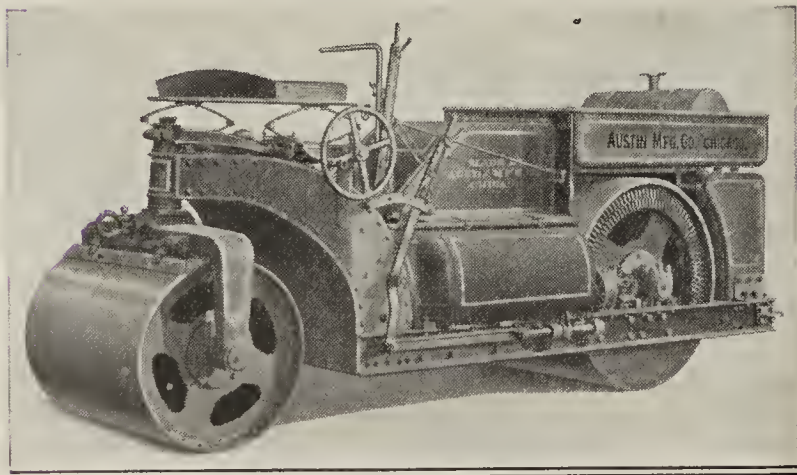
Road Graders	Blade Graders
Rock Crushers	Dump Wagons
Road Rollers	Stone Spreaders
Portable Store Bins	Street Sprinklers
Stone Elevators	Street Sweepers
Stone Screens	Motor Tandem Rollers
Elevating Graders	Motor Macadam Rollers

Our Catalogue No. 18, which describes almost 250 sizes and styles of the above equipment, will be sent on request.

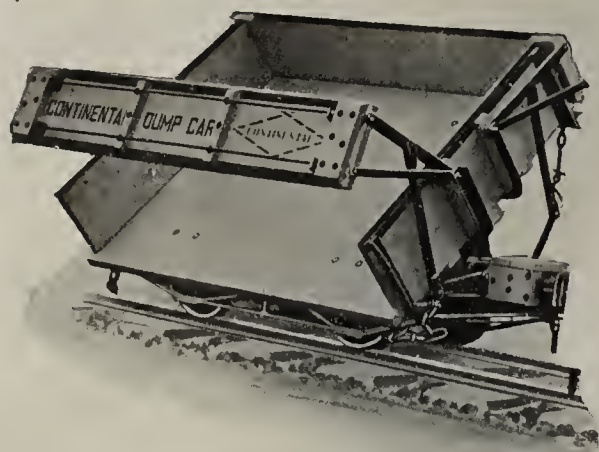
Austin-Western Road Machinery Co.

Chicago

Branch Offices in 13 Principal Cities



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ABILITY to stand up under the most gruelling tasks—under the most severe strains—has made the Continental name a by-word across the nation.

CONTINENTAL DUMP CARS

are noted for correct design, sturdy construction, highest grade of materials and workmanship, and they incorporate many new features not found in other cars.

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Continental Car Co. of America, Inc.

General Sales Office and Works, Louisville, Ky.

GRANOLITHIC

**A superior, colorless,
Liquid Cement Hardener**

GRANOLITHIC makes cement floors
Wear Proof—Dust Proof and Water Proof.

The dust that is so injurious to merchandise, machine bearings and motors is eliminated. The cost of treating cement with **GRANOLITHIC** is trifling compared to the economies effected.

Unsolicited testimonials tell the story. Write for full particulars today.

GRANOLITHIC COMPANY, Inc.

471 N. Snelling Ave., St. Paul, Minn.

Midway

**LIQUID
CEMENT
FLOOR HARDENER**

Buckets



from stock

CONSISTENT with our efforts to match the high standard of quality of Link-Belt products with an equally high standard of service, we carry a liberal stock of such parts as are destined to wear and require replacement.

Our stock of malleable iron buckets is complete in every sense, placing us in a position to make immediate shipment of practically any standard size or type. The vast number of Link-Belt buckets in use and demand enables us to maintain a force of molders who specialize in bucket casting. The material entering these buckets is of the same high standard as that used in malleable Link-Belt for which we are known the world over.

Buckets are furnished punched or plain. In ordering, state whether buckets are to be punched for flat belt or Link-Belt, and if for the latter, give size and number of strands of Link-Belt and style of attachment.



Style "A".
The "A" Bucket is the Standard Form and the Most Generally Used.



Style "AA".
"AA" has heavy reinforced front edges and corners, which increases the life of the bucket in handling material of a siliceous nature.

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ELEVATING EQUIPMENT

We Also Make

- ☐ Elevators and Conveyors
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- ☐ Silent Chain Drives
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- ☐ Electric Hoists
- ☐ Locomotive Cranes
- ☐ Wagon Loaders
- ☐ Coal and Ashes Systems

Write for Catalogs
Place X in Square

A Hettrick Conveyor Belt

Making Wonderful Endurance Records at This Plant



"Has given us better satisfaction than any other belt we have ever used"

writes J. L. Thomas, Superintendent, Tioga Gravel Co., Alexandria, La., whose plant is illustrated above.

The success of Hettrick Red Stitched Canvas Conveyor Belting is a plain case of "survival of the fittest." When mills similar to yours come back repeatedly with orders covering their conveyor belt requirements—what stronger evidence of merit can you ask?

The rains of spring, the heat of summer, the droughts of autumn the cold of winter, may do their utmost, but Hettrick continues on the even tenor of its way, doing its work faithfully and well, be it outdoors or indoors.

As a piece of workmanship it is the perfection of cotton weaving. As a transmitter of power it is unsurpassed. As a conveyor it is unequalled.

We would like to send cement and lime manufacturers and gravel, sand and crushed stone producers a sample and folder that tells the whole story of Hettrick Conveyor Belting.

The Hettrick Mfg. Co.
TOLEDO, OHIO

Increase Your Output— —Lower Your Cost



For much construction work and in many branches of the industrial field this is easier said than done, but for the gravel producer and the contractor with a job of excavation such a result is realized immediately upon the installation of

SAUERMAN Dragline Cableway Excavator

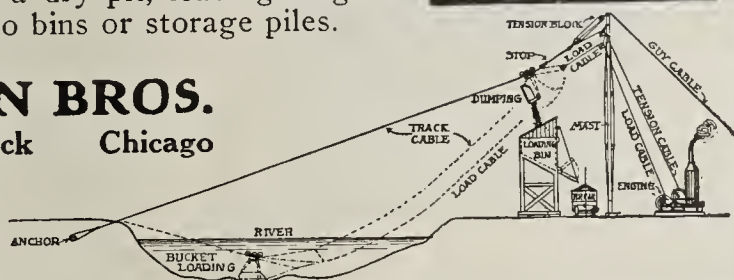
This machine, operated by a double drum hoist and "UNDER THE CONTROL OF ONE OPERATOR," accomplishes the digging, conveying, elevating and dumping all in one continuous operation.

Designed for digging and conveying material under water or from a dry pit, loading wagons or cars and delivery to bins or storage piles.

SAUERMAN BROS.

1139 Monadnock Block Chicago

Manufacturers of Dragline Cableways, Excavators, Power Scrapers and Cableway Accessories.



LITTLE DAILY LEAKS OF POWER BOOSTS YOUR COAL BILL

The High Cost of Power Is Reduced to a Minimum By the Use of a

Plamondon Disc Type Friction Clutch

The power of this clutch is unusual. The double toggles on this clutch develop such tremendous pressure that even on the largest clutches only a hand lever is needed to engage or disengage the clutch. The geared devices usually needed to operate large clutches are unnecessary.

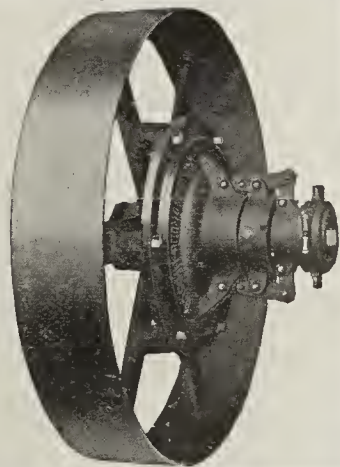
This is only one of the practical advantages the cement mills find in this clutch. Write for our new catalog No. 59 and learn the rest of them.

WE ALSO MANUFACTURE GEARS

A. Plamondon Mfg. Co.

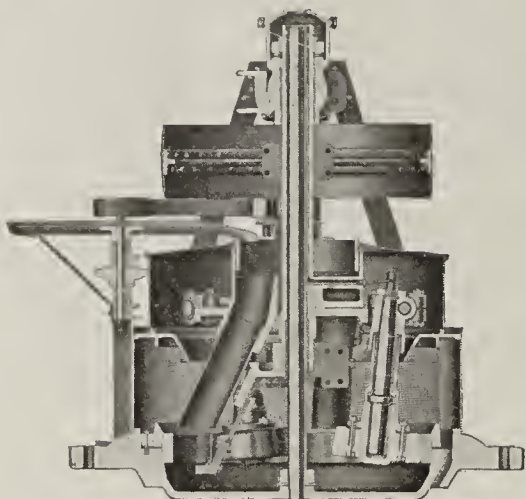
12-24 N. Clinton St.

CHICAGO, ILL.



The Wonderful Performances of the Bradley Hercules Mill

AS A preliminary pulverizer of cement rock, limestone and clinker, has demanded investigation of its merits. Most of the progressive cement manufacturers are either buying or investigating this machine. It is surprising to know how many of these mills are in successful operation and more surprising to note its tremendous output, extreme fineness, low horse-power consumption and exceptionally low maintenance cost. Why not let us send list of installations, or one of our engineers, to show you how much more efficient this mill is than your present preliminary machines?



This mill has taken its place as the most economical preliminary machine ever used in the cement or agricultural limestone plant.

Let us give you complete data on its performance for the last five years—it's yours for the asking.

Twenty-two mills sold without advertising—a record unequaled in the cement industry.

BRADLEY PULVERIZER CO.

BOSTON

— LONDON —

Works: ALLENTOWN, PA.

Most Vulcan Customers Re-Order

Many of the largest cement manufacturers have used Vulcan Kilns for years.

Our customers, when re-ordering, almost without exception have specified Vulcan Kilns.

The reasons for this are:

- 1st—The painstaking care with which Vulcan Engineers study each customer's specific needs.
- 2nd—Vulcan specialized manufacturing facilities.
- 3rd—Vulcan skilled workmen.

Write for Information Today.

Vulcan Iron Works

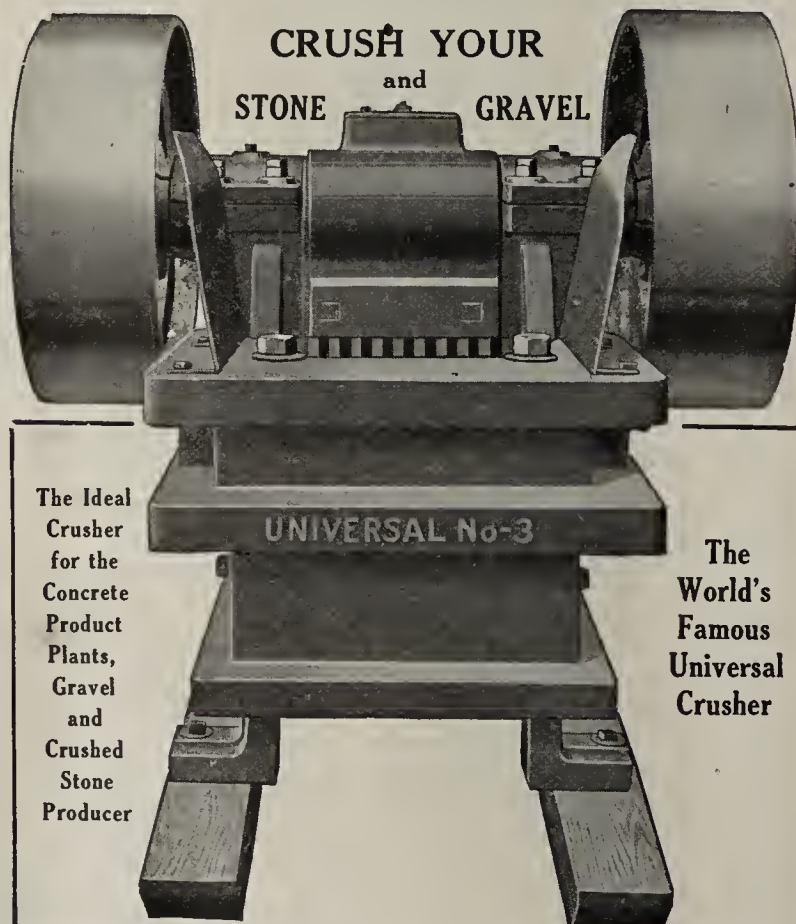
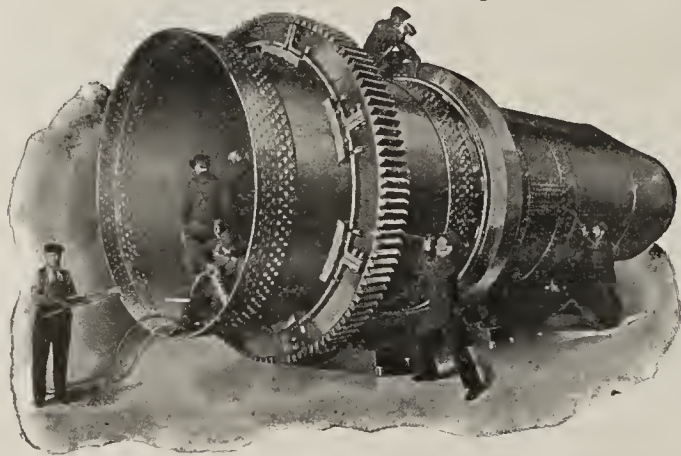
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Wilkes-Barre

New York

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The Ideal
Crusher
for the
Concrete
Product
Plants,
Gravel
and
Crushed
Stone
Producer

The
World's
Famous
Universal
Crusher

**We Build Crushers from 5 Tons to 300 Tons
per 10-hour Capacity**

Instantly adjusted to produce size required from
 $\frac{1}{4}$ inch to 3 inches Write for Folder No. 14.

UNIVERSAL CRUSHER COMPANY

230 Bee Ave

Cedar Rapids, Iowa, U. S. A.

Cement and Engineering News

Vol. 31

Chicago, March, 1919

No. 3

Rapid method of loading and hauling material at the yards of the Superior Sand and Gravel Company, Lima, Ohio. With the loading tank and the dump body the standing time of the motor truck is cut to a minimum.



Editorial

Six States Show Building Deficiency of \$500,000,000,

It will take approximately \$500,000,000 expended in buildings in Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and New York to make up the building deficiency incident to the war. This construction work must be in addition to the normal, current requirements of 1919.

The Information and Education Service of the U. S. Department of Labor has issued the results of a study of building needs in these six states, made by the Economics Section of the Division of Public Works and Construction Developments. Taking the building permits issued in 1914, 1915 and 1916 to obtain an average representative of the normal year's requirements and comparing this average with the permits actually issued during the war years of 1917 and 1918, the Information and Education Service establishes the actual reductions in buildings in twenty-one cities.

To obtain an approximation of the building deficiency in the several states, it is assumed that the building deficiency in the state is in the same ratio to those in the cities, as the property valuations of the state are to those of the cities.

Nine cities form the basis for the figures in New York State and from the actual decreases in building activities in these it is estimated that New York's building deficiencies for 1917 and 1918 are not less than \$236,000,000. Massachusetts shows up \$214,000,000 short, the basis for the computation being actual falling off in the building permits in seven important cities of which Boston is one, Maine, New Hampshire and Rhode Island show \$8,000,000 or more and Vermont's building deficiency is \$4,960,000.

New York City shows a deficiency of \$173,192,304 while the figures for Boston are \$70,258,082. The normal building activities for 1917-18 in New York, on the basis of building permits issued in 1914-15 and 16, should have been \$318,315,367—they were but \$145,123,063. Boston to have approximated normal should have shown building permits totaling \$100,898,780 for 1917 and 1918. Its total was but \$30,640,698.

Potash in Cement-Mill Dust

"Potash in Cement-Mill Dust," is title of an article appearing in the January issue of the Journal of Industrial and Engineering Chemistry, by Albert R. Merz and Wm. H. Ross, based on work carried out at the Bureau of Soils, U. S. Department of Agriculture, Washington, D. C. In view of the importance of the recovery of potash from the flue dust of cement mills, the following information as to the nature of the recombined potash thus recovered may be of interest.

The analyses have shown that in some cases potash recovered from the dust was found to consist in part of a material insoluble in acids, while its other part was soluble in acids but insoluble in water.

Further, it was found that in the oil-fired plant of the Riverside Portland Cement Company the greater part of the potash in the dust was readily soluble in water, while in dust collected at plants where coal is

used for fuel it was found that the greater part of the total potash was acid-soluble, which greatly reduces its value for use as a fertilizer.

The present article discusses the origin of the water-insoluble potash in the dust and comes to the conclusion that its presence is due first to the ash of the coal and the dust carried over mechanically, but also possibly to the fact that a certain portion of the potash has been volatilized in the process of burning and has undergone a recombination during its passage from the kiln.

As a practical suggestion, it is stated to be probable that the proportion of recombined potash in those dusts which contain free carbon might be reduced to some extent if more of an oxidizing atmosphere was maintained in the kilns during the burning of the cement.

Also, the experiments described in the article lead one to believe that the addition to the raw mix of a salt of sodium, such as sodium chloride or common salt, would bring about a reduction of the recombined potash such as has actually been observed at the plant of the Security Cement and Lime Company. Further, little recombination of potash with coal ash takes place in the carbon-free mixtures when lime is present.

Finally, the greater the amount of potash volatilized the lower will be the proportion that will undergo recombination in the dust.

Lime for Agricultural Purposes

Director H. J. Baker of the Connecticut Agricultural College has sent to all county agricultural agents of that state a letter in reference to the use of agricultural lime during the season of 1919.

Director Baker states in view of the facts:

(1) That our farms should produce at full capacity in order to more nearly feed our people within the state, and thereby draw less heavily on food supplies from other states in which it is needed for the duration of the war and during the reconstruction period in feeding the world.

(2) That practically all our farms in Connecticut are in need of lime, and must have liberal applications before their producing capacity can be most economically increased.

(3) That our farm labor supply has been so seriously reduced, it is necessary that the fertility and productivity of our land be increased as one means to maintain the food supplies with less labor.

It is his conviction that there should be no limit to the sale of lime for agricultural purposes, as was proposed by the order of the War Industries Board, restricting the distribution and sale of lime to farmers to such amounts as the directors of extension might see fit to follow. Mr. Baker states, that in the case of Connecticut, no restrictions would have been placed on the amount of lime which farmers might purchase to be used for agricultural purposes, under the aforesaid order. Mr. Baker also takes the position, that county agents should point out to the farmers, that in view of the fact that lime companies are having difficulty in maintaining a sufficient supply of labor to put out an adequate supply of lime to meet the demand, orders

for lime should be placed early. He states that it is his understanding that lime companies are making no guarantee to deliver orders received after March 1, and also feels that farmers buying less than carload lots should pool their orders, insofar as practical, so that carloads may be shipped to any one point.

Removal of the Concrete Forms

Mistakes are frequently made in removing forms from concrete work before it is well hardened, and one should be sure the concrete is strong enough to stand without supports before the forms are removed. Concrete hardens more slowly in cold than in warm weather; a lean mixture, less rapidly than a dry one; cold, rainy weather also delays hardening. Therefore it will not do to state that the forms can be removed safely at a given time after the concrete is placed. All conditions must be taken into account and judgment exercised or the entire structure may collapse.

Care should also be taken to remove the forms with the least possible hammering or pounding. Shocks resulting from pounding on the forms are likely to injure the fresh concrete. To overcome this difficulty, forms should be erected so that few nails are used to hold them together. A desirable method to accomplish this object is to nail blocks or cleats to the upper members of the form and force the braces into position so that they will hold without nails.

Walls supporting earth on one side, as in cellar walls, are subject to much heavier pressure when the ground is full of water than when it is dry and this should not be lost sight of. The walls should be protected and allowed to harden for a longer time if there is a likelihood of this condition developing.

After the forms have been removed, concrete walls and foundations should be sprinkled several times a day for about a week or ten days and protected against too rapid drying, by covering them with burlap. Floors, walks and pavements should be kept wet by covering them with sand, earth or other materials that will retain moisture, but will not stain the concrete. In this connection it might be well to state that where the earth water rises and remains near the surface during certain seasons of the year, it will be advisable to provide a tile drain around the outside of the cellar walls, leading this to a natural outlet; also a drain should be laid from a point beneath the basement floor to connect with the drain around the foundation.

Tests Show Value of Fine Grinding of Portland Cement

Fine-ground cement, specified to pass 90% through a 200-mesh sieve, is being used in the government concrete ships. The tests on which this use was based are reported as follows in the annual report of the Bureau of Standards for the fiscal year which ended June 30, 1918:

"The series of tests, started in 1916, to determine the effect of increased fineness on the cementing value of cement in mortar and concrete has been continued. The two-year results show the same marked decrease in strength with the finer ground cements as did the tests of the previous year.

"With knowledge of the general results of this investigation the Emergency Fleet Corporation requested further comparative tests on various cements

produced in the Southern districts, both as normally ground and as reground to a fineness of 90% passing the 200-mesh sieve. These cements were tested in 1:1:2, 1:1½:3, and 1:2:4 concretes and in 1:2 mortar. In practically all cases the increase in compressive strength obtained with the finer cements was from 50 to 100 pound per square inch for each per cent increase in fineness. From all the data obtained in this investigation the order of increase in strength which may be expected from finer grinding by ordinary methods is now fairly well established, and the question of requiring higher fineness in the standard specification for portland cement is a purely economic one. There remains, however, the highly interesting and almost wholly unattacked problem of producing cements of much higher fineness than is possible by ordinary methods of grinding. It may confidently be expected that if practical methods can be found of reducing cement clinker to a very fine state of subdivision, a decided improvement in quality will result. To determine what degree of improvement may be obtained is properly the next step in this investigation.

"The importance of further progress along these lines is commensurate with the difficulties to be overcome in developing new methods of grinding, and concentrated effort will be required to deal with the new problem effectively. Fortunately, some progress was made before the war by the development of an air separator and an air analyzer for the production and mechanical analysis of very fine cements."

The Magnesite Industry in Washington

In the State of Washington two companies are operating plants for producing magnesite. They have spent large sums of money during the last two years in developing quarries and building plants, and are now able to produce raw and calcined magnesite in large quantities. Each company can now turn out more than 10,000 tons of raw magnesite a month. The Northwest Magnesite Co. is making several thousand tons of ferromagnesite a month in a large plant which it has erected at Chewelah, 60 miles north of Spokane. The plant includes five rotary kilns, each 120 feet long, which are fired with pulverized coal. The machinery is driven by electricity furnished by the Stevens County Power & Light Co. Two 300-horsepower gas engines, together generating 400 horsepower, have been installed at the plant for additional power. The American Mineral Production Co. ships several thousand tons of raw magnesite a month from Valley to Irvin, 8 miles east of Spokane, where it is converted into ferromagnesite in the plant of the International Portland Cement Co. It is reported that the output of ferromagnesite from this plant in October, 1918, was about 150 tons daily.

Practically all the magnesite produced in Washington goes in the dead-burned form to steel plants and to manufacturers of refractory products east of the Mississippi. Manufacturers of magnesite stucco and composition flooring use California magnesite and are now having some difficulty in obtaining an adequate quantity of material of the quality they desire, although their total requirements can easily be supplied by one mine of moderate capacity. It is suggested that the use of crystalline magnesite for making Sorel cement might be made the subject of further experiments.

Electric Motors in the Cement Industry

By R. B. Williamson

ABSTRACT OF PAPER

This paper has been compiled by the Committee on Industrial and Domestic Power of the American Institute of Electrical Engineers to give general information regarding the different classes of machinery used in the cement industry and the sizes and types of motor best adapted for the work. The paper gives, first, a brief description of the process. This is followed by an outline of the various kinds of machinery used together with data as to power requirements. The types of motor best suited to each application together with starting characteristics, overload capacity, torque and other features are indicated.

(Continued from February issue)

Fairmount Crusher

Many of the more recent crushing plants for cement works use the Fairmount type crusher. This machine consists of a single roll working against an anvil plate. The roll is provided with knobs from two inches to three inches in height for crushing against the anvil plate and with sledging knobs from three inches to four inches in height for breaking the large pieces of stone on top of the roll, which are too large to be directly gripped between the roll and the anvil plate. These machines have a very large capacity when operating continuously, but are not objectionable for small capacity on account of their very low friction load when running idle.

The Fairmount type crusher is built in sizes 24 × 36 inches, 24 × 48 inches and 24 × 60 inches, also 36 × 60 inches and 60 × 84 inches, in each case the size being

of the roll is greatly decreased and an increase in the power required will be noted. With the ratio of 4 to 1, the power requirement remains practically constant whether the reduction is from 4 inches to 1 inch or from 1 inch to ¼ inch. The amount of material crushed, however, will be in proportion to the size, *i. e.*, when reducing from 4 inches to 1 inch the rolls will handle four times as much material as when reducing from 1 inch to ¼ inch; all other things such as size of rolls, speed, etc., remaining constant. Any increase or decrease in the speed of the rolls will increase or decrease the quantity handled and the power required.

Due to irregularity of feed, variation in size and hardness of material, etc., it has been found that the power required is not steady but fluctuates as shown by Fig. 7 which is a power diagram of a 42 × 16-inch roll operating

TABLE 2.

Power Requirements of Blake Crushers.
Dry Limestone.

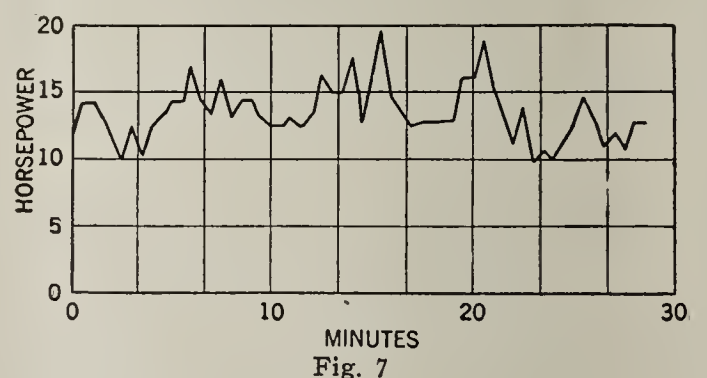
Size or jaw opening $b \times w$	Capacities in tons per hour											Approx. horse power req'd
	Size of product											
	$\frac{3}{4}$ in.	1 in.	$1\frac{1}{2}$ in.	2 in.	$2\frac{1}{2}$ in.	3 in.	4 in.	5 in.	ϕ	s	R	
10×7 in.	1.5	2.5	4	5					26°	$\frac{5}{8}$ in.	275	7
15×9 in.		6	8	10	12				26°	$\frac{7}{16}$ in.	275	10
20×10 in.			10	15	17.5	20			26°	$\frac{1}{2}$ in.	275	15
24×12 in.				20	25	30	35		26°	$\frac{9}{16}$ in.	275	25
30×18 in.					30	37.5	45	50	26°	$\frac{9}{16}$ in.	275	40

referred to diameter and face of the roll. The size which has so far been used in cement plants is 36 inches in diameter by 60 inches face. This size of machine ordinarily requires a 150 horse power motor to drive it and it has a capacity of from 200 to 500 tons per hour, depending upon the character of the material to be crushed. One of the particular advantages of the Fairmount type crusher is that it makes a very large reduction in one operation so that the number of secondary crushers is reduced and the product from the primary crusher being smaller can be much more easily handled into and out of storage bins.

The starting torque required for the Fairmount crusher when idle, is very low so that squirrel-cage motors are often used. While it is not possible to start the crusher full of stone even with slip ring type induction motor, the latter will give sufficient torque to start up the crusher without entirely cleaning it out, if it should happen to stop under load. Slip ring type motors are therefore, recommended for this class of work.

Crushing Rolls

The most favorable condition for crushing rolls is obtained when the ratio of size of feed to product does not exceed 4 to 1. When this ratio is exceeded, the efficiency



at 60 revolutions per minute and reducing dry iron ore from a maximum of two inches to an average of one-half inch, the average power being 13.18 horsepower.

Fig. 8 shows the relation existing between horse power per cubic foot per hour and different ratios of reduction assuming maximum size of feed material and average size of product, all friction of the rolls being neglected. This curve has been plotted as an average of points obtained from actual tests. It is to be noted, however, that while dry material has been rolled, most of the points indicate power readings taken while crushing iron ores, and that only one point refers to the rolling of dry lime-

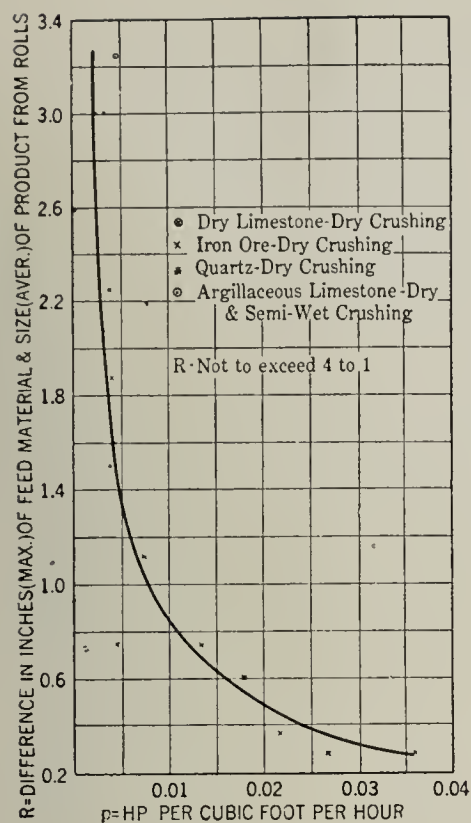


FIG. 8

stone such as is used in the cement industry. As the iron ore is a harder substance than the limestone, it is reasonable to assume that the curve as drawn shows values slightly higher than would be obtained had more data been available on dry limestone.

The friction of crushing rolls, that is, the power required to drive the rolls at their normal speed and without load, varies considerably for different sizes, speeds and makes of machines, but an approximate average is obtained from the following:

$$P_1 = 0.0835 (D + W)$$

where P_1 = horse power

D = diameter of rolls in inches

W = face of rolls in inches.

When figuring the power requirements of crushing rolls it is preferable to obtain the friction of the rolls direct from the manufacturers.

The amount of material passed by the rolls is

$$M = \frac{d \times W \times S}{144} \times 60$$

where M = cubic feet of material per hour

d = distance in inches from edge to edge of roll (See Fig. 9.)

W = face of rolls in inches

S = peripheral speed of rolls in feet per minute.

The above formula gives the theoretical capacity and is the one used in figuring the power requirements. In order, however, to obtain the actual capacity, the theoretical capacity should be divided by 4. This is on account of irregularity in feed, etc.

The total power required to drive rolls for any different rolling condition is

$$P = (p \times M) + P_1$$

where P = total horse power

p = horse power per cubic ft. per hour (Fig. 8)

As the starting conditions are not severe, the squirrel-cage induction motor makes a suitable machine for driving the rolls, provided the conditions are such that this type of motor is connected to a source of power where line disturbances are not objectionable. If line disturbances are objectionable, the slip ring type of induction motor should be used. When shutting down the mill, the usual procedure is to first cut off the feed to the rolls, allowing same to empty themselves, before closing down the motor. No difficulty, however, is likely to be experienced with

the squirrel cage type of motor, if called upon to start the rolls when full of material and with the feed open, as even under these conditions the starting requirement is not severe.

Intermediate Crushers

Hammer Mills. These machines are made in several styles but all make use of the same principle, namely, the use of hammers revolving at high speed and abrading the material against a slotted iron casing. Unlike the crushing rolls, where a reduction not exceeding 4 to 1 is most favorable, the hammer mill is used for reducing material of from $2\frac{1}{2}$ to 1 inch to 20 mesh or less, the maximum reduction in this case being 76 to 1. As the power required to drive this type of mill varies considerably, due to irregularity in feed, it is most important that they remain steady and therefore a feed regulator is highly desirable. In addition to this, any variation in the size and hardness of material, provided the feed remains fairly constant, will also cause power fluctuations which will however be within reasonable limits.

There is very little general power data available on hammer mills other than for a specific manufacturer's type, trade size and specific speed or speeds. The latter are supposed to be the most efficient speed at which the particular mill should operate. A general rule gained by experience indicates that in order to crush one ton of dry limestone in one hour, reducing from a maximum size of $2\frac{1}{2}$ inch to 20 mesh, requires six to seven horse power. This would be the output of a motor and would include the friction load, in addition to the crushing load, of the mill. The actual capacity of any mill is proportional to the size of the product and to some extent to the character of the feed so that for different sizes of product on any given mill, the power requirements will be different.

Sturtevant Hammer Mills are of two types known respectively as hinged hammer and hammer bar mills. The hinged hammer mills are of the general type noted above under this class. The bar hammer mill differs in that there is only one set of hammers instead of six or more and the hammers themselves have an axial length the full width of the rotating spider which carries them. Both mills take material in pieces from 5 to 6 inches wide. The hinged hammer mill reduces from one inch to 20 mesh and finer. It is built in three sizes and operates at a speed of 1,000 to 1,500 revolutions per minute. The hammer bar mill is built in two sizes and reduces from $\frac{1}{2}$ inch to 20 mesh. A belted wound-rotor motor is the preferred application. Squirrel-cage motors have, however, proved satisfactory, particularly if used when line disturbances at starting are not objectionable. In any case, if a mill is shut down it will have to be clear of material before started again.

Hammer bar mills are made in two sizes, No. 0 and No. 1. The No. 0 mill will handle from $1\frac{1}{2}$ to 4 tons per hour, depending on material, and requires from 8 to 10 horse power. The No. 1 handles from 4 to 12 tons per hour and takes 20 to 25 horse power.

Hinged hammer mills are made in three sizes 30 by 12 inches, 30 by 18 inches and 30 by 24 inches. The power varies widely with the material. The 30 by 12 inch machine, for example, might take a maximum of 30 horse power or a minimum of 10 horse power. The wider machines take increased power in proportion to the width.

TABLE 3
Power Requirements of Hammer Mills.
(Allis-Chalmers)

Trade Size	Rev. per min.	Hammer circle	Face	H. P.
No. 1	1800	24 in.	9 in.	15
No. 2	1200	30 in.	12 in.	30 to 40
No. 4	1200	42 in.	24 in.	75 to 90

The above requirements are based on crushing dry limestone, reducing from a maximum size of $2\frac{1}{2}$ inch to 20 mesh with a constant feed of material best suited to the particular mill.

Williams' Jumbo Crusher. The machine of this make used for intermediate crushing is usually the No. 6 size. It takes stone three inches in size and under and reduces it to $\frac{1}{4}$ inch and finer. The capacity is 60 to 65 tons per hour, and the motor requires 150 horse power. The mill operates at from 720 to 750 revolutions per minute. It prepares material for some one of the various finishing mills.

Vulcanite Crushers. (Williams). The Vulcanite crushers are also swing hammer mills. They are built in eight sizes having capacities from two tons per hour at $\frac{1}{4}$ -inch size up to 50 tons per hour at $\frac{1}{2}$ -inch size. The standard unit generally employed for cement work is No. 3. This takes material up to three inches and reduces it to $\frac{1}{4}$ -inch for feeding ring roll mills. It handles 15 to 18 tons per hour, operates at a speed of 1,000 revolutions per minute and requires 50 horse power.

Universal Grinder. (Williams). This is termed a tube mill feeder as it will take limestone $2\frac{1}{2}$ inches and under after passing through the dryers and reduce it to a product, 95 per cent of which will pass a 20 mesh sieve. These are built in ten sizes, the two most commonly used in cement plants being the No. 3 and the No. 9. The No. 3 handles from 8 to 10 tons per hour under the above conditions, requires from 50 to 60 horse power, and should operate at a speed of 1,100 revolutions per minute. The No. 9 size, used in plants requiring very large units, handles from 25 to 30 tons per hour, requires 175 to 200 horse power, and operates at a speed of 720 revolutions per minute. Wound rotor induction motors are the best application on all three mills. The preferred method of drive is by motor direct connected through a flexible coupling.

Sturtevant Rotary Crushers. This type of rotary crusher operates on the principle of the old fashioned

TABLE 4
Power Requirements of Rotary Crushers.

Machine size	Approx. capacity in tons per hour	Revolutions per minute	Approx. horse power
00	1 to $1\frac{1}{2}$	300	1 to 2
0	$\frac{1}{2}$ to 2	250	3 to 4
1	1 to 6	300	6 to 10
$1\frac{1}{2}$	4 to 10	200	15
2	8 to 15	250	15 to 20

coffee mill. It is shaped like an hour-glass or double cone, one cone mounted and reversed on the other. The coarse material is introduced at the top and is acted upon by a rotating cylindrical member which exerts a continual nipping action on the rock since the diameter of the stationary cone decreases as the material falls toward the center. Below the center the material is ground or shredded by the usual mill stone action. The lower portion of the rotating member is cone-shaped and so arranged as to leave a tapering annular space decreasing in size toward the bottom. As the material proceeds by gravity toward the bottom, it is ground and reduced in the annular space by the action of the rotating cone against the stationary one. Both these members are faced with hardened steel burrs or grinding members. These crushers are intended for moderately hard or soft rocks but are not used for hard cutting substances. They crush large rocks to approximately $\frac{1}{8}$ inch without screens in the smallest sizes and as coarse as 1 inch in other sizes. Their sizes, outputs and power requirements are as shown in Table 4.

A wound-rotor induction motor is the preferred application for these crushers but a squirrel-cage motor can

handle them if designed with considerable margin in starting torque.

Rotary Dryers

Dryers are used to dry the crushed limestone which contains a considerable amount of moisture that must be driven out before the grinding operation can be performed. They are also used for the same reason, for drying the clay and coal. The dryer consists of a large revolving cylinder which is sufficiently inclined to roll the contents through by gravity. It is heated either by oil, natural gas, or by the waste gases taken from the kilns.

Auxiliary machinery necessary for the dryer, are fans and conveyors, and usually this auxiliary machinery is considered as integral parts of the dryer, and is driven by the same motor. For a fixed rate of feed the load is constant and as a rule the dryers are operated at a given predetermined speed; therefore, squirrel-cage motors are satisfactory for this kind of service. Squirrel-cage motors with 125 per cent to 175 per cent starting torque, are

Approximate horse power requirements are as follows: suitable.

Size of dryer	Horse Power	Recommended speed of motor
6 ft. x 60 ft	12	700 to 1200
$6\frac{1}{2}$ ft. x 60 ft	15	700 to 1200

On some particular installations, the following was found. A dryer 6 feet in diameter 45 feet length, 9 revolutions per minute, connected to a 24-inch by 50-foot horizontal pan conveyor and to a 14-inch by 35-foot bucket elevator, required a 30 horse power motor. A 7-foot by 60-foot dryer for rock crusher, connected to a 20-inch by 45-foot inclined conveyor, and 16-inch by 40-foot elevator, required 40 horse power.

Ordinarily, dryers of 5-foot diameter and 50-foot to 60-foot length, revolving at 3 to 5 revolutions per minute, were found to require between 10 and 20 horse power.

Preliminary Grinding Machinery

Ball Mills. The Ball mill consists principally of a revolving horizontal cylinder lined with overlapping iron plates and containing a charge of steel balls. For the first charge, balls of $3\frac{1}{2}$, 4 and 5 inches diameter are supplied, but under running conditions only the largest size are added from time to time to maintain the charge. These mills will take material up to 6 inches in size. The material as ground falls through perforations in the iron plates to the cylindrical screen or hopper which surrounds the mill, and the oversize rock falls back through the same perforations to the grinding plates. The fine product is removed by a conveyor below the machine and is generally of such fineness that all will pass a 20 to 30 mesh. When pulverizing to pass all through a 20 mesh, from 30 to 40 per cent will pass a 100 mesh sieve.

Ball mills are low-speed machines generally running from 20 to 25 rev. per min. The charge of balls revolving at this speed causes very severe vibration in the gearing, and motors geared to their countershaft have proved unsatisfactory. Belted motors or low-speed motors for direct connection to the countershaft through flexible couplings give entire satisfaction. When starting, the charge of balls and stone must be rotated through

TABLE 5.

Power Requirements of Ball Mills.

Make.	Weight charge lb.	Capacity on cement clinker bbl. per hr.	H. P. required.
Gates No. 7.....	3,000	12-16	30-40
" " 8.....	4,500	18-24	40-50
Smidth (Kominuter) No. 53- $\frac{1}{2}$	3,000	.....	30
" " " 66...	6,600	.....	75
" " " 88...	.....	.....	100
Krupp No. 7.....	3,520	12-16	30-35
" " 8.....	4,400	16-22	35-45
Chalmers & Williams.....	10,000	60-75	100-125

nearly 90 deg. before it begins to roll, and the motor torque required at starting varies from $1\frac{3}{4}$ to 2 times full-load torque. Squirrel-cage a-c. motors specially designed for this high starting torque have been successfully applied but they have a lower efficiency than wound-rotor motors and make a large current demand at starting. The same starting conditions are found in tube mills and as the size of these has steadily increased of late years, and as the power required has also increased with the use of metallic grinding bodies in the mills, there has been a gradual change to the use of wound-rotor motors in place of the high-torque squirrel-cage motor. Many of the latest mills are using wound-rotor motors for these grinders of large capacity and the saving in power due to increased efficiency, together with better performance at starting, warrants their use in preference to the squirrel-cage type. Table 5 indicates the power requirement for a few typical ball mills.

Hammer Mills. These mills which have been described above are used for preliminary grinding as well as for crushing.

Ring-Roll Mills

There are a number of different mills that may be classed generally as ring-roll. In these, the material is crushed by means of a ring or large balls rolling inside and against the ring or die. In some types this ring rolls also. There is enough difference in mechanical construction to require a brief explanation of each mill. Under this general type are classified the Kent mill, Griffin mill, Fuller mill, Bonnot mill, Raymond mill, Sturtevant Ring-Roll mill, Huntington mill and others.

These different types of mills are used in many combinations, depending on the material and the locality in which they are employed. An analysis of about fifteen mills shows that ball mills are widely used as intermediate grinders taking material from the crushers on the raw side and the kilns on the clinker side and reducing it to a suitable fineness for feeding tube mills. In another combination the ball mills are replaced by ring-roll mills. Another combination uses hammer-mills to reduce the material to $\frac{1}{4}$ inch and smaller, after which it is crushed in ring-roll mills. In other plants the entire operation of grinding the clinker in the finishing mill is performed by ring-roll mills.

Fuller Mill. Three sizes of this mill are manufactured—33-inch, 42-inch and 57-inch. The smallest mill is best adapted for use on coal or similar materials while the two larger machines are adapted either to coal or harder material such as limestone, rock or cement clinker. This mill accomplishes both intermediate and fine grinding in one operation. It takes material up to $\frac{3}{4}$ inch in size and reduces it to a fineness of 85 per cent through a 200 mesh sieve. The mill is vertical in construction and the grinding is done by four chilled unattached balls rolling against a circular horizontal die. The balls are propelled by four equi-distant horizontal arms or pushers radiating from the vertical shaft. The shaft is driven at such a speed as to cause the balls to exert a pressure against the die of approximately 1600 pounds. The material is fed in at the top of the mill by a screw and enters the pulverizing zone. By means of fans and screws the material is removed as soon as it has reached the proper degree of fineness. The driving pulley is mounted at the bottom. Squirrel-cage induction motors are used very satisfactorily to drive these mills through belts running in a vertical plane. Special vertical motors have been developed for this application.

The output of these mills and the power required to operate them depends upon the weight and hardness of the material being pulverized and the fineness of finished product desired. On the 33-inch mill the output will

vary from two tons per hour when grinding hard material, to four tons per hour when grinding soft material. The power will approximate 45 h. p. for hard material and 25 h. p. for soft material. The above figures are based on grinding to 100 mesh. On the 42-inch mill the output will vary from 4 to 10 tons per hour from hard to soft material, and the horse power will vary from 75 to 45 when grinding to 100 mesh.

The 57-inch mill when grinding raw cement material consisting of limestone and shale or clay or cement rock has a capacity of from 9 to 12 tons per hour and requires from 110 to 125 h. p. The same mill when pulverizing cement clinkers has a capacity of from 500 to 600 barrels per day and requires from 135 to 150 h. p. The performance of the 57-inch mill is based on grinding to 85 per cent through a 200 mesh sieve.

It should be borne in mind that the power required for the different machines as given in this paper represents average performances. It is possible under certain conditions to crowd all these machines thereby increasing their output and also increasing the power consumed so that specific instances are no doubt known to all engineers interested where the figures are somewhat higher than here given. These are matters that take care of themselves in practice.

Kent Mill. The Kent mill consists principally of a revolving ring and three rolls pressing against its inner face. The rolls are convex and the ring is concave and tracks on the rolls. Springs support the rolls yieldingly and the rolls support the ring so that the four crushing parts are free to move. The material falls from the inlets onto the inner face of the ring, and centrifugal force holds it there in a layer an inch deep as it passes under the rolls. The latter are pressed by the springs outwardly against the rock or the ring with a pressure adjustable to 20,000 pounds, the adjustment being accomplished by means of the screws against the springs. As the rolls pass over the rock they crush it against the ring, while the crushed rock falls off each side of the ring into the casing and then into the discharge. It is claimed that 90 per cent of the rock is abraded on itself in crushing so that the wear on the parts of the machine is materially decreased.

The torque required to start this mill does not exceed full-load torque, since the moving parts are comparatively light and there is only a small amount of rock in the machine at a time. The pull-out torque of the motor supplied should be comparatively high as large pieces of rock passing between the rolls and ring will cause severe momentary overloads.

In order to obtain a fine and uniform product, the ground material is usually elevated from the discharge to a screen or separator above the mill and the oversize is returned to the feed. The elevator and separator will add from $7\frac{1}{2}$ to 10 h. p. to the figures given below for the mill alone. The feed should preferably pass through a one-inch ring but anything up to two inches can be handled. The finished product will all pass a 20 mesh.

These mills are made in three sizes known as the Kent mill, the "Maxecon" and the "Big Maxecon" mill. Their capacity depends on the hardness of the material and the fineness to which it is ground. Round approximations might be 25 barrels per hour for the Kent, 35 for Maxecon and 50 for Big Maxecon. These mills operate at 200 rev. per min. and the usual sizes of motors are 30, 40 and 50 h. p. for the Kent, Maxecon and Big Maxecon respectively. When grinding clinker one h. p. per barrel is the average power consumption to pass 20 mesh; also the product will approximate 50 per cent through 100 mesh and 35 per cent through 200 mesh.

Raw rock varies so in hardness that capacities range from 7 to 16 tons per hour, and power estimates from

five h. p. per ton for the hardest to three h. p. for the softest.

Sturtevant Ring-Roll Mill. This ring-roll pulverizer consists of a steel anvil ring or die secured in a head supported and revolved by a horizontal shaft. Against the inner face of this ring the three hammer rolls are elastically pressed with great force and revolved by the ring. Substances to be ground are fed to the anvil face of the rotating ring and held thereto by centrifugal force and are crushed by being drawn under the rolls, as the ring revolves. The face of the anvil ring is concave and the rolls convex, thereby crowding the material as it is finished to the outside edges of the ring. These mills may be used with elevator and separator, thus securing very uniform product. They take material up to 1½-inch size and reduce it to a fineness varying from ⅛-inch to 100 mesh or finer. They are usually employed as a preliminary pulverizer rather than a finishing mill for cement work. As is the case in mills of this type, the operation of crushing is largely performed by abrading the rock on itself so that the wear on the mill parts is reduced. These mills are made in five sizes; three sizes of single mills and two of duplex mills which are a double unit. Table 6 gives the sizes, horse power and speed. Regarding the output, the manufacturers furnish this on request, since it varies widely with the nature and conditions of the material handled. As an illustration the following figures are cited for the No. 2 duplex mill. Grinding cement clinker to 20 mesh, 80 to 100 barrels per hour, and to 80 mesh 30 to 40 barrels per hour. Grinding limestone to 20 mesh 16 to 20 tons per hour and to 80 mesh 8 to 14 tons per hour.

TABLE 6

Power Requirements—Sturtevant Ring-roll Mills			
Size	Pulley Speed rev. per min.	Ring Speed rev. per min.	Approx. h. p.
0	125	125	8 to 12
1	320	80	15 to 20
2	300	63	25 to 45
No. 1 Duplex	375	80	30 to 40
No. 2 Duplex	325	64	70 to 90

The elevator and separator if used add about 8 h. p. per single mill. A squirrel-cage induction motor is the preferred type for these mills.

Huntington Mill. The ring-roll mill is a vertical shaft machine with a horizontal spider from the rim of which are suspended four spindles. These spindles carry at their lower end a heavy horizontal crushing roll. The rotation of the main shaft causes these crushing spindles to swing out by centrifugal action and roll against a ring die. The material is fed against this die and crushed by the rolls.

These mills are made in four sizes, but the largest size is suited only for wet grinding. The other three sizes are 3½ ft., 5 ft., and 6 ft. and require 5, 8, and 10 h. p. respectively. This mill is a preliminary pulverizer and not a finishing mill. A belted squirrel-cage motor is a satisfactory application.

Bonnot Mill. This ring-roll type of mill employs air separation of the material. The driving shaft is horizontal and the grinding ring or die is held in a vertical plane in the main frame. The rolls are carried by a head or driver mounted on the main shaft and are free to be thrown outward by centrifugal force, thus furnishing the crushing pressure. The material thrown upward into the screening chamber by the motion of the grinding parts is deflected against the screen by the blades of a fan. The coarse material strikes a baffle and falls back into the grinding chamber while the fine material passes through a screen and drops through passages

into the conveyor. The 36-inch size is used for cement; it operates at 180 rev. per min. and requires 75 h. p. It takes pieces up to two-inch size and when working on clinker will handle 13 to 16 barrels per hour of which 96 per cent will pass 100 mesh and 77 per cent 200 mesh. It will be seen from this that it is a finishing mill as well as a preliminary grinder. When grinding raw material and fed through ⅝-inch grate it will handle 4 to 5 tons per hour, 97 per cent through 100 mesh. A squirrel-cage a-c. motor is the preferred application.

Griffin Mill. This mill employs in its construction the principle of a roll running against a ring or die. Power is received by a pulley running horizontally, from which, by means of a universal joint, a shaft is suspended in pendulum fashion. To the lower extremity of this shaft is rigidly secured the crushing roll which is thus free to swing in any direction within the case. The base or pan contains the ring against which the holl works and upon the inner surface of which the pulverizing is done. On the bottom of the roll are shoes for stirring up the material and throwing it against the ring, and above the roll are attached blowers for blowing the fine material through the screen which surrounds the base. When at rest the roll hangs vertically beneath the driving shaft, but when revolved it flies out to the die ring and travels around in a direction opposite to that of the driving pulley. There is a pressure of approximately 6000 lbs. due to centrifugal force brought to bear on the material being pulverized between the roll and the die. These mills are manufactured in three forms known as the "Bradley Hercules," the "Bradley 3-Roll" and the "Giant Griffin" mills. The Bradley Hercules takes material two inches and under and reduces it to a fineness of 53 per cent through a 100-mesh screen at the rate of from 40 to 50 tons per hour, using about 250 h. p. in the operation. When used as a preliminary grinder of cement clinker it has an output of from 150 to 175 barrels per hour and requires 250 h. p. to drive.

The Giant Griffin mill has an output when grinding clinker of from 25 to 30 barrels per hour to a fineness of 60 per cent through a 100-mesh screen. It takes material ¾ inch and under for feed and when operating to full capacity requires about 80 h. p. This mill is a very efficient preliminary machine on account of the high percentage of fineness and has sometimes been used as a finishing mill.

The 3-Roll mill in theory is similar to the Griffin, but employs three rolls instead of one. A squirrel-cage a-c. motor is the preferred application for these mills except the Hercules which is better equipped with a phase-wound-rotor motor on account of the starting conditions on so large a unit.

Raymond Mill. This mill performs the operations of preliminary grinding and finishing in one process. The grinding ring is mounted in a horizontal plane and the grinding is performed on its inner surface by means of rolls suspended from a rotating driving head or spider. There are two, three, four, or five of these rollers, depending on the size of the mill. A prominent feature of this mill is the system of air separation employed. When handling raw material the mill will handle about one ton per hour per roll, *e. g.*, the 4-roll and 5-roll mills will handle four or five tons per hour respectively from a size of ¼ inch to 1½ inches to a fineness of 95 per cent to 98 per cent through a 100-mesh sieve. There are six sizes in all called two-roller mill, three-roller mill, four-roller mill (low side or high side), and five-roller mill (low side or high side). The power consumption is given as follows:

2 rolls	45 to 50 h. p.	3 rolls,	55 to 60 h. p.
4 "	75 to 80 h. p.	5 "	85 to 90 h. p.

The driving motor is belted. A squirrel-cage induction

motor with good starting characteristics is the preferred application.

Emerick Pulverizer. This is a vertical mill and the crushing is done by four or five 12-inch or 14-inch steel balls which are unattached and roll in and against a grinding race. These balls are driven by a head or spider which keeps them properly separated. The centrifugal force set up in the balls by the rotation of the driving head causes them to exert great pressure against the grinding race, thereby crushing and abrading the material in the mill. The mill is arranged with five 12-inch, four 14-inch, or five 14-inch balls. This mill may be used either as a preliminary grinder or as a finishing mill. When used as a finishing mill it is equipped with an air separator and will reduce from $\frac{1}{2}$ inch and under to 95 per cent to 98 per cent through 100-mesh and 80 per cent to 90 per cent through 200-mesh. On raw material or coal it will handle six to eight tons per hour and clinked 12 to 20 barrels of finished cement per hour. The mill operates at 90 to 130 rev. per min. and requires 35 to 60 h. p. A belted squirrel-cage motor is the proper application either vertical or with a quarter-turn belt.

Symons Disk Crusher. This crusher is of a special type in which the crushing is done by two dish-shaped disks mounted on horizontal shafts which are separate but one of which gyrates slightly with respect to the other. The two disks are set with their concave sides facing each other and are rotated in the same direction at the same speed. This results in the hollow between the two disks having a wider opening between their edges at one part of a revolution than on another. This progressive pinching action admits a piece of coarse material at one time and as the disks rotate they approach one another thus crushing the material which is then thrown out through the opening between the edges of the disks if it is reduced to the proper fineness; if not, the process is repeated.

A wide range of adjustment is provided by changing the distance between the crushing disks. These crushers are made in four sizes as given in Table 7. A squirrel-cage motor with a maximum starting torque of $1\frac{1}{2}$ to $1\frac{3}{4}$ full load torque is satisfactory on this application.

TABLE 7.

Power Requirements of Disc Crushers.

Size of crusher...	18 inch	24 inch	36 inch	48 inch
Size of material fed	$1\frac{1}{2}$ inch	$2\frac{1}{2}$ inch	$3\frac{1}{2}$ inch	$6\frac{1}{2}$ inch
Size to which reduced	$\frac{3}{8}$ inch	$\frac{1}{2}$ inch	$\frac{3}{4}$ inch	1 inch
Tons per hour....	5 to 8	12 to 15	25 to 30	45 to 60
H.P. required	12 to 18	18 to 25	30 to 40	50 to 65

Such material is too coarse to finish in tube mills, but could be handled by some of the types of ring roll finishing mills described in this paper.

Finishing Grinding Machinery—Tube Mills

For the fine grinding of limestone or clinker, the tube mill is used extensively, both wet and dry. The usual form is that of a rotating cylinder and the grinding is done by attrition or by the rubbing together of the grinding medium and the material to be ground. The mill is generally filled to about the center line, and the grinding medium, or charge, as it is usually called, consists of either flint pebbles, cast iron balls, or forged steel balls, etc., depending on the design of the mill and the comparative costs of the various grinding mediums. There are several types of tube mills in commercial use, designated as follows:

TABLE 8.

Plain Tube Mills with Flint Pebbles.

Operating in Portland Cement Plants with 20 Mesh Feed and Grinding, to 95% through 100 mesh and 80% through 200 mesh.

Size of Mill—	Capacity on raw material		Capacity on clinker.		Horsepower		R.P.M. mill.	Initial charge pebbles.
	2,000-lb tons per 24 hr.	666-lb. bbl. per 24 hr.	380-lb. bbl. per 24 hr.	120 to	To start	To run		
3 ft. 6 in. x 20 ft..	50	150	144	60	35 to 40	40	40	9,800
4 ft. 0 in. x 20 ft..	64	192	192	70	45 to 48	35	35	11,600
4 ft. 6 in. x 22 ft..	80	240	240	85	55 to 60	31	31	14,500
5 ft. 0 in. x 22 ft..	117	350	350	120	75 to 80	28	28	20,000
5 ft. 6 in. x 22 ft..	157	470	480	150	95 to 100	26	26	24,000
6 ft. 0 in. x 22 ft..	192	575	575	185	115 to 125	24	24	29,000
7 ft. 0 in. x 22 ft..	280	840	815	250	160 to 175	20	20	39,000

The above figures are based on the charge and material level being carried at the center line of the mill.

1. The plain tube mill using flint pebbles as a grinding medium.

2. The plain tube mill with ball-peb compartment. This type of mill has a partition located near the discharge end. The large compartment on the feed end is charged with cast iron or forged steel balls.

3. The ball-peb mill using cast iron or forged steel balls as a grinding medium.

4. The combination or compeb mill with a partition located near the feed end. The small compartment of the feed end is charged with large cast iron or forged steel balls while the large compartment on the discharge end is charged with small cast iron or forged steel balls.

The power requirements of these different types of mills vary not only with the size of the mill, but also with the nature and amount of the charge used. Once the mill is started, the load is practically constant and only slight pulsations in power can be noticed. The power required to drive these mills has been determined from actual tests and refers to dry grinding conditions only. For wet grinding the power required is approximately 30 per cent less than for dry grinding, other conditions remaining the same. The power requirements for the four types of mills, as noted above, are as follows:

1. The plain tube mill using flint pebbles—see Table 8.
2. The plain tube mill with ball-peb compartment; add 20 per cent to the power requirements of the plain tube mill using flint pebbles.
3. The ball-peb mill; see Table 9.
4. The combination or compeb mill; see Table 9.

The most economical speed for any mill should be such that the bulk of the charge is carried to the highest possible point in the mill before falling and this without any of the charge or material being carried around by centrifugal force. This is approximately

$$s = \frac{195}{\sqrt{d}}$$

where s = revolutions per minute.

d = diameter of mill in inches, including the lining.

On this basis of speed and for the dry grinding of limestone and clinker, the power required to drive any of these various types of mills may be approximated by the following:

$$P = \left\{ [0.0034 (W + W_m)] \frac{R}{r} + 0.00015 w \right\} \times \frac{S}{s}$$

where P = Horse power.

W = Weight of charge of pebbles or balls in pounds.

W_m = Weight of the material being ground in mill.

w = Weight of revolving elements of the mill in pounds.

install it in such manner as to protect it as far as possible from the heat radiation of the kiln. For the same reason motors selected for this work must be liberally rated and have low temperature rise.

Kilns vary in size from 6 ft. 6 in. diameter by 100 ft. length to 10 ft. 6 in. by 200 ft. and revolve at speeds ranging from 3 to $\frac{1}{2}$ rev. per min. They require from 10 to 30 h.p. The load is very steady and the horse power requirements are nearly proportional to the speed of the kiln, to the square of the diameter, and to the length. Approximately 125 to 175 per cent starting torque is required.

Table 10 gives approximate power requirements of rotary kilns. The power requirement varies with the speed as shown in the last two columns and the rating of the motor, on account of the severe operating conditions, should be twice the lower value there given. In selecting the resistance for controlling the speed, care must be taken to have it proportioned so as to be capable of reducing the speed to one-half when the load is that actually required to drive the kiln at half speed.

After the material has passed through the kilns it is ground in the finishing mills. For this work the same class of grinding and conveying machinery is employed as that previously described.

Construction of Concrete Grain Bins with Steel Forms Supported on Central Mast

A 5-bin, 22,500 bu. capacity, concrete grain storage tank was built in 6 weeks' time with a gang of 5 men, by the Polk, Genung, Polk Co., of Fort Branch, Ind., for the Hanley Milling Co., of Coshocton, O. The battery consists of four 12-ft. circular bins 51 ft. high, spaced 33 in. apart, with straight connecting walls, forming a central interstice bin of about the same capacity as the circular tanks. The foundation is a 12-in. reinforced concrete slab, 30 ft. square with a 12 in. footing around the outer edge. This foundation slab forms the roof of the 6 ft. by 6 ft. conveyor tunnel, extending under the bins and paralleling the flour mill.

The circular walls of the bins are 6 in. thick, and the straight connecting walls are 8 in. thick. The reinforcing in the bin walls is $\frac{1}{2}$ in. square twisted steel rods on 8 in. centers in the first 30 ft., and $\frac{3}{8}$ in. rods on 8 in. centers for the remaining 21 ft. The straight walls carry the same reinforcing longitudinally, the bars extending into V-shaped grooves cast in the circular walls at the point of contact. Vertically the reinforcing consists of $\frac{3}{8}$ -in. bars on 29 $\frac{1}{2}$ -in. centers. The bins have a unit construction concrete roof, 8 in. thick at the center and 4 in. at the edge. The roof reinforcing is $\frac{1}{4}$ -in. steel bars, on 6-in. centers. Surmounting the roof is a 12-ft. circular concrete monitor, containing the elevator and turn heads; all spouting is done directly into the tops of tanks and within the monitor.

The concrete walls for two circular bins were constructed simultaneously. Polk, Genung, Polk Co. steel forms of the standard type employed by the contractors for construction of cylindrical structures were employed. These forms are 4 ft. high, and are made with steel plates having exterior horizontal angle stiffeners and vertical angle flanges at the joints between sections which are disconnected to permit stripping



Fig. 1—Arrangement of Forms, Radial Arms, Scaffolds and Mast.

and moving the forms. The forms and scaffolds are suspended from a mast, consisting of a heavy 4-in. pipe centered with the bin, and are moved upwardly as the work progresses by means of steel jacks with a 4-ft. stroke, carried on an iron collar attached to the mast. A radial derrick arm with trolley hoist for elevating and delivering concrete to the forms also is attached to the mast. The arrangement is shown in Fig. 1. Figure 2 shows work underway on the second pair of bins. All the workmen on the job are shown in the illustration. —[Engineering and Contracting].

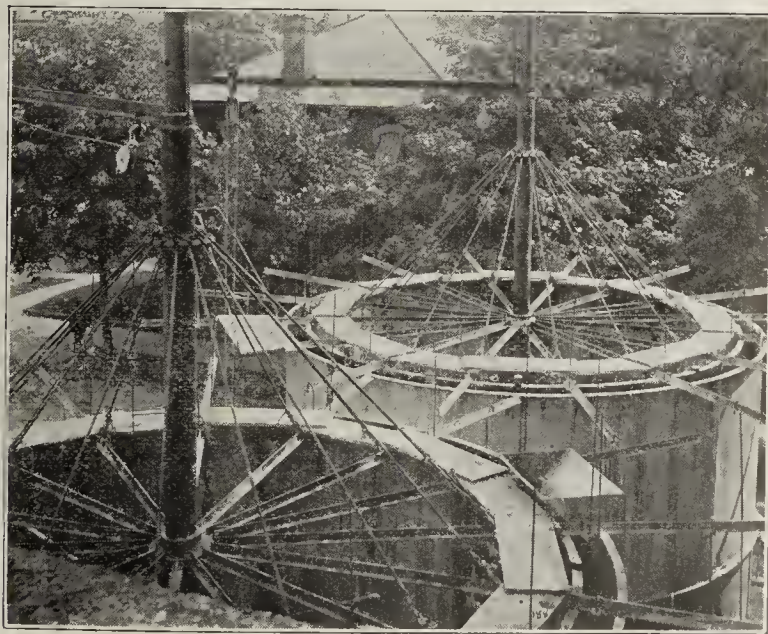
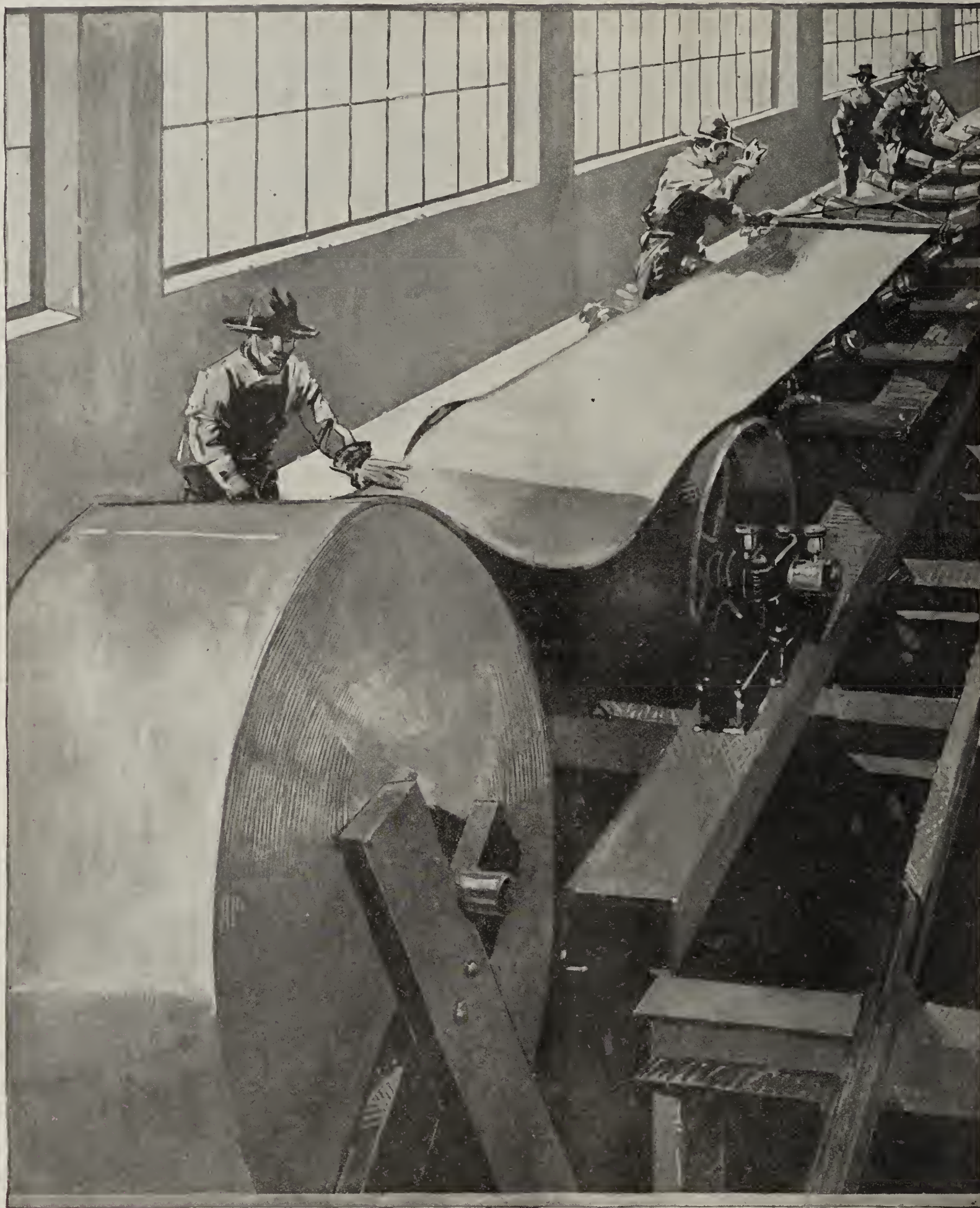


Fig. 2—Work Under Way on the Second Pair of Bins.

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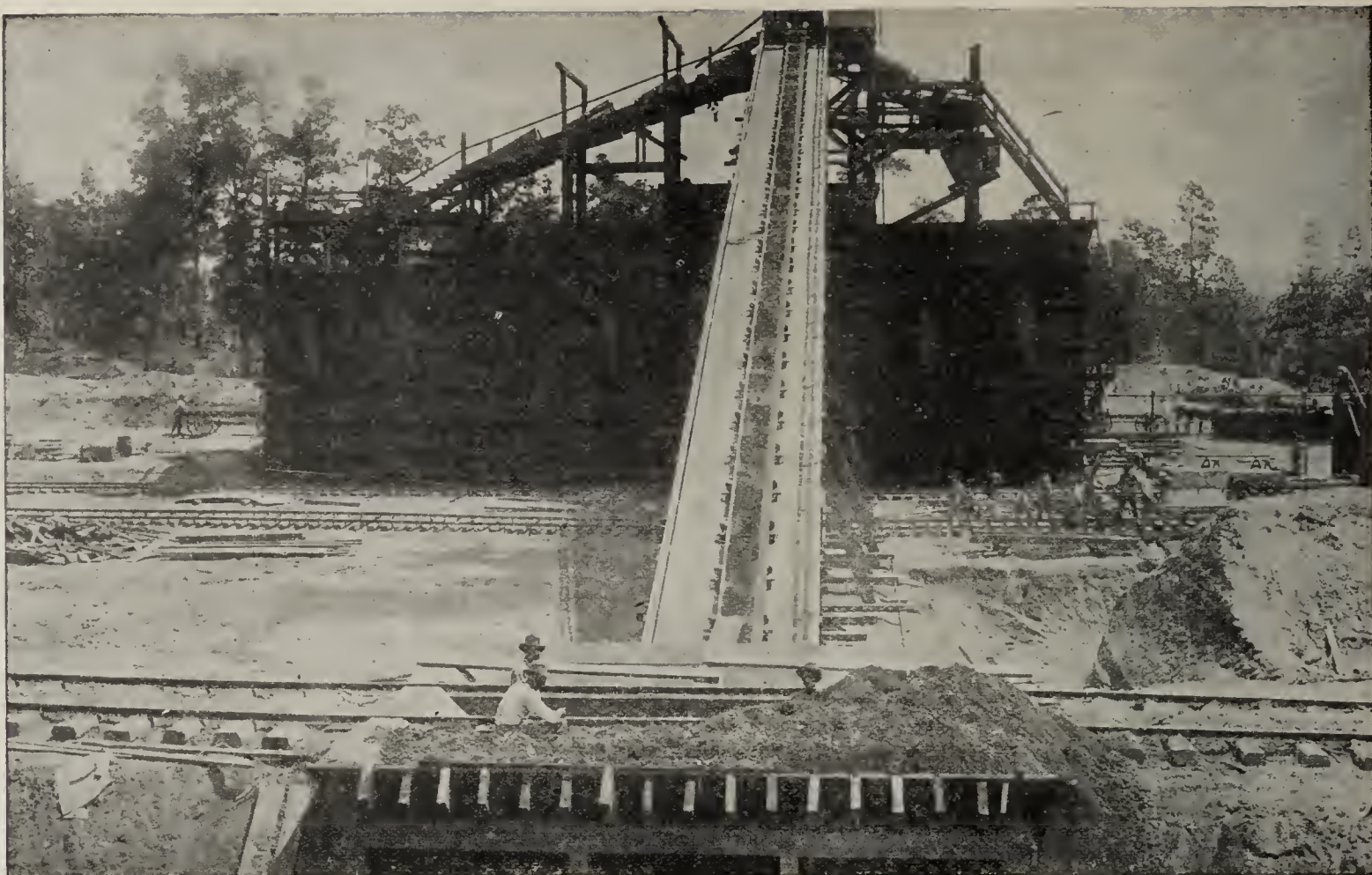
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Gravel Screening and Washing Plant of the Tioga Gravel Co., Alexandria, La.

The Plant of the Tioga Gravel Co.

The organizers of the Tioga Gravel Co., Alexandria, La., to work Louisiana sand, clay and gravel deposits, put \$20,000 into first plant and nearly ten times as much in promotion work. Their reward is an increasing string of plants now worth over \$300,000.

Their gravel screening and washing plant, illustrated herewith, is located 12 miles from the city of Alexandria, La., which point they named Thomas, after their general operating superintendent, I. L. Thomas, upon whose experienced knowledge of Louisiana gravel possibilities they have built the immense southern gravel business that has developed from the central plant.

They made their first investment chiefly with the idea of developing the road building movement on a large scale in Louisiana, and from the time when they invested their first \$20,000 up to today, when they are operating three plants valued at over \$300,000, the building of highways with gravel and the spreading of gravel gospel has been their greatest ambition. In the work of placing the great adaptability of Louisiana gravel for road purposes prominently before the public they have spent and are still spending large sums of money. Before they took an order for gravel, after they had established their \$20,000 plant, they spent \$150,000 entirely in introductory development work. They built the first sand-clay-gravel country road in Calcasieu parish to the sulphur mines of southwest Louisiana five years ago, and since then Calcasieu has spent \$2,000,000 more in constructing sand-clay-gravel roads throughout the parish. They claim, and have records to prove it, that 85 per cent of the road gravel used in Louisiana is Tioga gravel furnished by the Tioga Gravel Co. of Alexandria, La.

The Tioga Gravel Co. is capitalized at \$200,000 and they are operating the acknowledged largest sand-clay-gravel operation in the country.

All of their plants, of which they have three, are bank gravel propositions. The largest and oldest one

is at Thomas, La.; the smallest and second oldest at Glenmora, La., and the newest and second largest is situated at Howcott, La. They are uncommonly simple operations. The gravel deposits being worked at the three plants aggregate approximately 2,000 acres, all being of the sand-clay type. They are all located in Rapides parish, the first and last, north, and the second and smallest, south of that city. The Glenmora and Howcott plants are exclusively pit run propositions. All of the washing and screening is done at the Thomas plant but much of the output of Glenmora and Howcott is shipped direct and unwashed from those two points to the points of use.

Besides the gravel deposits now being worked, they also own considerable other excellent deposits at various points in the state.

The Thomas plant is approximately 12 miles from Alexandria and is not located on any trunk lines, but the Tioga company has its main line running 9 miles from Thomas to a connection with the Missouri Pacific Railroad and the Louisiana Railway & Navigation Co. Other trackage owned by this company in connection with the Thomas plant consists of three miles of switch tracks at the interchange yard and four miles of switch tracks at the plant proper. The 9-mile main line is of the best type of railroad construction and is laid with oak ties and 70-pound steel. There are two locomotives at Thomas and one steam shovel. The large pumping plant there is equipped with duplex compound pumps with a 12-in. suction and a 10-in. discharge. This plant pumps water from Beaver Bayou for washing purposes.

The daily output of the washing and screening plant is 25 cars of gravel and 10 cars of sand. And the storage bins have the same capacity. They have their own waterworks system and water tower at Thomas, which were designed and installed by I. L. Thomas, their general superintendent, who has directed the operations at Thomas and elsewhere from the very first day this concern commenced to produce Tioga gravel. They have their own blacksmith shop and roundhouse

and their own town and office buildings and a large supply of dump cars. The gravel deposits at Thomas cover about 1,500 acres and the entire investment there is valued at \$225,000, conservatively.

The second oldest and smallest plant is at Glenmora, and is purely a pit run project. It is located on the Red River & Gulf R. R., which is a small line connecting with the Missouri, Pacific, Texas and Pacific, Southern Pacific and Rock Island railroad systems. The equipment at this plant consists only of one steam shovel, one 50-ton locomotive, one mile of switch track, water system, office building and 50 acres of sand-clay-gravel deposits, and represents an investment of only about \$25,000.

The plant at Howcott is the newest, having been completed and put in operation only last May. It is about 29 miles north of Alexandria on the Missouri Pacific railroad, and represents at present an outlay of over \$50,000. It consists of 2 miles of main line and 2 miles of switch track and a 1-mile pit track. The operation is with steam shovel and dump cars. This plant has its own waterworks, also designed and installed by I. L. Thomas, and like the Glenmora proposition, this project is also strictly a pit run operation. The Howcott daily production capacity is 100 cars, and the gravel deposits there cover an area of about 400 acres.

The same simple method of production is followed at all of the plants, except that, as has already been noted, all of the washing and screening is done at Thomas. A brief explanation, therefore, of the process at Thomas will suffice for all.

Method of Operation

A. D. Alderson, vice-president, manager and treasurer, thus describes the method of production:

"The sand-clay-gravel produced is a natural concreting material which can be applied on roads without washing and in its natural condition. It contains fifty per cent small flint rock and fifty per cent sharp sand and cementing ferruginous clay, which, when wet and rolled, sets up like concrete.

"The material is loaded directly in cars by the steam shovels and is shipped at once to the point of use, unless it is to be used for concreting purposes, which logically requires that it be washed. In such case, it is loaded in the plant dump cars rather than in open railroad cars. The dump cars are switched and the sand-clay-gravel mixture dumped into the hopper and conveyed by belt to the top of the washing plant and there discharged into a drum into which at the same time a 10-inch stream is being pumped. The mass is thoroughly stirred up and the mixture discharged into screens of different sizes on each of which a two-inch double stream is constantly playing. The different sizes of gravel drop through the different sized screens and are carried into bins. The clay is then washed out of the sand by further rinsing and the sand is deposited into the two end bins. There are two loading tracks alongside the bins where cars are spotted for loading. The chutes are then dropped and the gravel automatically discharged into the cars."

George J. Olsen, superintendent, California Portland Cement Company's plant at Colton, Calif., announces that beginning February 20th the plant would start operations with its full quota of men. The plant is now employing only 30 per cent of the full force of men. Within the next ten days the management is planning to start up four kilns.

News Items

The Edison Portland Cement Company is now making a feature of export operations through its export department, 8 West Fortieth street, New York City. The company has developed a patented box for packing the material for export shipment, insuring perfect condition of the cement when it reaches its destination. The company is now operating its plant at New Village, N. J., at a capacity to meet all demands for export orders, as well as for domestic business.

The Nugent Sand Company, of Louisville, is building a number of new barges, 100 feet in length at its local landing, having recently launched the first of a fleet. The barges are being constructed of first class material throughout and built for long years of service.

The Missouri Portland Cement Company, Union and Planters Bank Bldg., Memphis, are operating several boats on the Mississippi river and are furnishing gravel and sand for numerous contracts in Tennessee and adjacent states, also cement for several jobs started last year. They anticipate, they state, a first-class spring trade.

Cement Mill News

The Missouri Portland Cement Company filed suit in the circuit court against the Kansas City Light and Power Company to recover \$40,000 which the cement company alleges it paid for excess charges for electric current used in its plant at Cement City, near Kansas City, Mo.

In its petition the plaintiff states that on July 12, 1912, it entered into a contract with the old Kansas City Electric Light Company to furnish electric power for its plant at Cement City at five and one-half mills per kilowatt hour; that on March 1, 1917, the name of the Kansas City Electric Light Company, by a reorganization proceeding in the federal court, was changed to the Kansas City Light and Power Company; that immediately thereafter the light company raised its rates, in spite of the contract, to one cent per kilowatt hour; that the cement company protested, but had no means of continuing its business other than through power and energy supplied by the light company, as it had taken out its steam driven plant and equipment in reliance on said contract. Therefore the cement company alleges that it was compelled to pay the increased rates.

The cement company says that later it entered into a compromise agreement with the light and power company and deposited with the light company \$40,000 to cover the excess charges between the rate in the original contract and the increased rate made by the light company, with the provision that if the Missouri Public Service Commission should disapprove of the contract, then the money deposited should be returned to the cement company.

The plaintiff declares in its petition that on August 1, 1918, the defendant went before the state public service commission, and without any authority of law, and in spite of the contract between the plaintiff and the defendant, the rate for electric current was again raised.

The cement company declares that the contract between it and the light company was not of a public nature, but was strictly a private contract, and that therefore the public service commission had no legal right to interfere.



The Recently Built Lime Plant of the Kelley Island Lime & Transport Co., at Buffalo, N. Y., Burns Stone Brought from Their Ohio Quarries, Shown Above.

New Up-to-Date Lime and Pulverized Limestone Plant

No expense has been spared by the Kelley Island Lime and Transport Company of Cleveland, O., in making their new lime and pulverized limestone plant, which they recently completed in Buffalo, N. Y., the last word in design and equipment.

Situated in the city of Buffalo between the Hamburg turnpike and the Buffalo river, it comprises $3\frac{1}{2}$ acres of land and has a dock frontage of 500 ft. on the river, where the largest lake vessels can tie up and unload the raw material. This stone is brought from the company's quarries at Kelley's Island and in Michigan.

The company's large quarries at Kelley's Island have been in operation since 1885, and recently the company purchased 2,000 acres of high calcium limestone land a mile west of Rogers City, Mich., which is being developed by installing a large crushing plant using a 6 by 7 ft. crushing roll with a capacity of 20,000 tons per day.

Stone is brought by boat from the quarries and unloaded on the dock at Buffalo, where the company has storage facilities for 300,000 tons. This is sufficient to carry the plant over the winter months, when navigation is closed.

At the mill is being manufactured all grades of lime products, consisting chiefly of agricultural ground limestone, agricultural hydrated lime, masons hydrated lime, building lime, lump lime and high calcium lump and hydrated lime for the chemical industries.

The plant has a capacity of 500 tons of agricultural ground limestone per day, 125 tons of lump lime and 150 tons of hydrated lime, which will be increased as the trade warrants. The whole plant has been designed to double the capacity without a single change in the elevating and conveying systems, as all these have been designed for a capacity of double the amount they are at present handling.

Simplicity in design and in economical operation has been the keynote in the make-up of the whole plant, as all the plans were prepared and the construction done under the supervision of the company's own engineering department, and with twelve plants in operation and years of experience, the engineers have picked out the best and eliminated that which experi-

ence has taught them is not of the highest value in operation.

The new Buffalo plant has some new departures from ordinary lime practice—the buildings are all steel construction, and all storage bins and coal bunkers are of either steel or reinforced-concrete construction. The buildings are all covered with galvanized corrugated iron and are fireproof throughout.

The limestone is unloaded on to the dock and storage pile, and is carried into the mill by a 16-in. belt conveyor. The method of loading from the storage pile on to the belt conveyor is accomplished by using a 30-ton locomotive crane handling a $1\frac{1}{2}$ -cu. yd. bucket. The stone is deposited in a movable hopper over the belt conveyor. This hopper has a capacity of 8 tons, and underneath is an automatic ore feeder which is driven by a direct connected 2-h. p. electric motor. This feeds the stone regularly on the belt at any capacity from 10 to 50 tons per hour.

The stone is conveyed and discharged into an elevator just inside the mill, which elevates it into a steel storage bin over the dryer. This bin has a capacity of 200 tons. From the storage bin the stone is again fed automatically into the dryer, which is a large size direct and indirect heat dryer with a capacity of 50 tons per hour.

The dryer is fired with an underfeed stoker, which is so graduated that a constant heat can be maintained at all times, and in addition burns all the smoke so that the stone is discharged from the dryer uniformly dry and with no discoloration from the coal. The dryer is operated by a 40-h. p. motor, which drives the dryer and fan. This fan furnishes the means of conveying away all the moisture in the shape of steam. This in turn is put through a centrifugal dust collector, and all the limestone dust is separated from the hot gases and steam and deposited in a separate bin, from which it is stocked and sold for asphalt dust and all other purposes where very finely pulverized limestone is required. All of this dust will pass a 200-mesh screen.

Pulverizing Plant

After leaving the dryer the stone is elevated into a revolving screen where all the fine material under $\frac{1}{2}$ -in. is screened out and deposited in another 200-ton bin to be ground into agricultural limestone. The

material passing over the $\frac{1}{2}$ -in. screen is carried by a 14-in. belt conveyor over to the rotary kiln building and there stored in a 200-ton reinforced-concrete bin to be fed into the rotary kiln and calcined into lime.

The small stone or dust is automatically fed into a steel storage bin over grinding mills, and from there is passed through the mills and ground so that all will pass a 12-mesh screen. From there it is again elevated and carried by screw conveyors, either direct into the cars, when loading bulk orders, or is deposited into a packing bin of 50 tons capacity, underneath which is located a packing machine for filling paper bags.

The balance of the pulverized limestone is conveyed over and deposited in three large circular reinforced-concrete bins having a capacity of 300 tons each. Underneath the bins is a large tunnel with a screw conveyor which feeds into an elevator. The elevator delivers to enclosed chutes which in turn deliver the dust to a packing bin or load direct into the cars.

Going over to the rotary kiln building, as stated above, all the stone running from $\frac{1}{2}$ to $1\frac{1}{4}$ -in. is deposited in a large circular reinforced-concrete bin having a capacity of 250 tons, and is here fed automatically into the rotary kiln, which is a heavy duty 8x150-ft. type.

This kiln is fired by a large modern revolving, automatically fed-and-raked gas producer. It has a capacity of 40 tons of gas coal per day of twenty-four hours. The coal is unloaded from hopper cars direct to a large crusher underneath the track, where it is crushed to 1-in. size and smaller, and is then elevated and stored in a 150-ton steel coal bunker, where it feeds by gravity into the automatic feeder of the gas producer.

Installed at the end of the rotary kiln is a 400-h. p. upright water-tube boiler, which receives the hot gases as they pass from the kiln. This boiler is capable of generating 200 h. p. of steam at 150-lb. pressure from these waste gases, which in ordinary practice are allowed to escape by the stack and are wasted.

This boiler is also equipped with grates and furnaces so that it can be hand fired in addition to utilizing the waste heat, and it is capable of developing 500 h. p. The power thus generated will be used for blowing the gas producer and to furnish additional power in the future when other kilns and mills are added to the plant.

As the hot lime leaves the kiln it is elevated and passed through a large 7x70-ft. revolving four-compartment cooler, where it is cooled down to a low temperature before passing over to the hydrating mill. This cooler is large enough to take the product of two 8x150-ft. rotary kilns so that in the future to double the capacity it will be necessary to install only the kiln.

From the cooler the lime is again elevated and discharged to a 14-in. belt conveyor, where it passes on a bridge over the railroad tracks and is deposited into a large rectangular reinforced two-compartment storage bin, each compartment being capable of holding a day's run of the kiln. The lime is then drawn through gates in the bottom of the bins and carried forward on a 14-in. belt conveyor over to a Williams hammer mill and there ground fine for hydrating, or it can be bypassed around the hammer mill and carried up by an elevator and discharged direct into the cars for bulk lime shipments.

The lime after passing through the hammer mill is elevated and discharged into a large reinforced-concrete storage bin having a capacity of 150 tons, and is

carried forward over the poidometer which automatically weighs the lime and water and is discharged into a hydrator, having a capacity of 12 to 15 tons per hour.

After being properly hydrated the lime is passed through two large grinding mills (manufactured by Raymond Bros. Impact Pulverizer Co., Chicago) where it is finely ground and air-floated, after which it is elevated and discharged into four large circular reinforced-concrete bins of 200 tons capacity each, or is discharged direct into large packing bins underneath which are located two 4-tube Urschel-Bates valve bag packing machines, which automatically fill and weigh the bags ready for shipment.

This description completes the whole process of manufacturing ground limestone and lime in its various finished grades. It will be noticed that every department is made very flexible. All machines, elevators and conveyors are driven by independent motors, and on account of the large storage systems for both the raw material and finished product, any department can be run from twenty-four to forty-eight hours from storage, so that ordinary repairs or breakdowns can be taken care of without affecting any other department than the one where the repairs are being made.

The bins will carry inside the mill nearly 700 tons of raw stone both wet and dry; the lime bins will carry 450 tons of lump lime for hydrating. Besides this, there is storage capacity for 750 tons of finely pulverized ground limestone and 800 tons of finished hydrated lime. This arrangement of large storage capacity, while expensive to install, assures the most economical and continuous operation of the whole plant.

Cement Mill News

Ben H. Hines, an employe at the Trinity Portland Cement Company's plant, at Eagle Ford, Texas, was crushed to death when a mass of rock and earth caved in on him.

James T. Abbott resigned his position as chief chemist for the Union Portland Cement Company, Devil's Slide, Utah, on December 31. He has accepted a position with the George A. Lowe Company, wholesale hardware dealers, Ogden, Utah, of which company his father's general manager.

War time restrictions on production and use of cement and the high cost of labor and material, cut down the business of the Wolverine Portland Cement Company in 1918 to a point where the company's operations represent a loss of about \$22,400, says the company's annual report to the stockholders.

Cost and scarcity of labor advanced the cost of cement for barrel about 20.9 per cent over 1918 and 33.3 per cent over the 1916 rate. Cost of operating supplies and material advanced and greater difficulty was experienced over non-delivery and inability to purchase material than in any other year of the company's history.

Acceptance of Indiana and Illinois coal reduced cement production approximately one barrel to the ton of coal. Under government orders building construction was discouraged as also, was road building. The government is now encouraging activity in both lines.

The company's balance sheet lists total resources of \$1,245,180 on December 31, last, against \$1,174,310 at the end of 1917. Current assets were appraised at

\$271,545.43, against \$181,201 in 1917. Capital assets were \$926,073.41, against \$956,277.

Capital stock remained at \$1,000,000. Current liabilities were \$101,164.57, compared with \$29,044 in 1917. Surplus was \$125,381.61 compared with \$145,266 a year ago.

The Petoskey Portland Cement Company, Petoskey, Mich., has increased the price of crushed stone this year 10 cents a ton, making it cost 75 cents instead of 65 cents a year ago. The facilities for increasing their output of crushed stone are being increased this year and a dock will be built providing 22 to 24 feet of water at a cost of \$75,000. A building will be erected this summer to manufacture cement, and it is expected the machinery will be installed next winter to start operations in the spring of 1920.

The company will have a large market for crushed stone at Chicago and Gary, Ind. The limestone is used as a flux in making pig iron.

Capitalists from Iowa have purchased a cement plant built at Demopolis a few years ago by British interests, and will make it one of the largest cement factories in the South. A corporation with a capital of \$2,000,000 is now being organized for that purpose. The new plant will be controlled by the same interests that own a large cement manufacturing plant at Mason City, Iowa.

The new factory will be built on the banks of the river at this place, so as to get the benefit of both water and rail transportation. The government's new Warrior River barge line will afford direct water transit to Mobile and New Orleans and other Gulf coast points.

Raw materials used in the manufacture of cement, with the exception of gypsum, are to be found in abundance in this locality. The gypsum, which is used for preventing cement from hardening too fast, will be brought from West Virginia mines.

Tecumseh Gravel Company's New Washing and Screening Plant

The present-day demand for sand and gravel is chiefly for thoroughly washed, perfectly graded materials. The effect of this demand is appreciated by comparing plants of recent design with the plants they replaced.

The new washery of the Tecumseh Gravel Co. on the D., T. & I. R. R., $1\frac{1}{2}$ miles south of Tecumseh, Mich., furnishes an extreme example of the contrast between old and new methods.

The old plant of this company produced no washed material. Its principal output was bank run material of which an average of 800 yds. a day was shipped out. A small amount of dry-screened gravel and sand was produced by digging from the bank with a Jeffrey wagon loader, a machine commonly used for loading from stock piles to wagon and trucks. With this machine it was possible to dig from a bank alongside the railroad siding and elevate the material to a revolving screen which rejected the "oversize" and separated the material, producing one size each of unwashed gravel or sand. One kind of material could be loaded at a time. If a car was being loaded with gravel a chute from the screen loaded gravel into the car and the sand dropped to a storage pile to be rehandled later. A steam shovel excavated and loaded the bank-run material direct into gondola cars.



New Plant of Tecumseh Gravel Co.

The new plant shown in the illustration produces three sizes of washed gravel and two grades of sand—concrete sand and plaster sand. A slack line cableway excavator with a $1\frac{1}{2}$ -yd. Dull rear-dumping excavator bucket, operated by a 12x12 Lidgerwood double-drum, double-cylinder hoist, digs the material from the old pit, which had been worked to within a few feet of the water-line by the steam shovel. With the cableway it is possible to take out the under-water deposits, which tests have shown run to a depth of 70 ft. The operations of this cableway will cover a radius of 500 ft. from the washery.

The cableway excavator digs, elevates and conveys the material to a hopper, which feeds the screens. Then, in turn, the material passes through a Dull preliminary scrubber of 60-in. diameter and 96-in. length and four Dull inclined conical gravel washing screens, each 63 in. by $31\frac{1}{2}$ in. by 84 in. The final step, separating the sand, is accomplished by two 72-in. Dull conical sand separators and a sand launder for the very fine sand.

The "oversize" gravel, rejected by the first screen, falls down a chute to a small bin at the front end of the plant to be crushed to $1\frac{1}{4}$ -in. size by a No. 5 Austin gyratory crusher and re-elevated to the screens by a bucket elevator.

A 100-h. p. Primm oil engine, manufactured by Power Mfg. Co., Marion, Ohio, furnishes power for the screens, bucket elevator and 5-inch centrifugal pump which pumps water to the screens. Rope drive from jack shaft of engine operates screens and elevator and the pump belt-connected to jack shaft.

The various sizes of material as fast as they are separated find their way into their respective storage bins. Loading for shipment is accomplished by spouts direct from bins to cars. Orders for bank-run gravel are still filled by using the steam shovel and working a new bank adjacent to the washery.

The present output of the washery with six or seven men employed is 500 yds. of all sizes of material in a 10-hour day. The plant has just been equipped with a modern electric spot-lighting system and will be operated day and night.

This plant was designed and equipped by the Raymond W. Dull Co. of Chicago.

Pressed Cement Brick

From the Helm Press.

One of the best machines, as well as one of the oldest on the market, for making concrete brick and blocks is the Helm press. These machines are being used all over the country and have met with great favor among concrete product manufacturers. Helm presses are not an experiment, they have stood the test for years. They are built along practical mechanical lines, scientifically and correctly designed, and are constructed from the best grades of iron and steel, each part carefully selected and machined. It is not intended that you should buy a new machine every season nor even a new machine every decade. The life of a Helm press is unlimited.

By a remarkable combination of power and action, the enormous pressure of 80,000 pounds (40 tons) pressure is developed on a Helm press. It is this terrific pressure that makes a Helm block and brick the finest looking and most permanent. This irresistible crushing power on medium wet concrete welds all the aggregates into brick and blocks that will resist the elements and last for ages. This uniform pressure drives the particles of cement and aggregate into a solid, uniform mass, filling out every edge and corner clean, sharp and strong.

The manufacture of pressed cement brick from the Helm press, faced with granite or other suitable material to enhance their appearance, is a sound, profitable, easily started business. A business that has put more men on the road to independence than perhaps any other business requiring the same amount of capital, time and labor to operate. Brick is a world-wide necessity—yes, right in your own locality. A business with both demand and profit. Helm cement brick are more favored by architects and builders, and are sold at a profit in competition with the high-priced pressed and enameled brick. The special granite facing is more accurately and economically done on the Helm press than on any other brick machine, as the material is placed in a measuring hopper on top of which the facing is placed. The pressure is applied from the top and bottom, so that all the advantages

of the face-down and face-up principle are secured, resulting in considerable saving of facing material used.

A unique feature of Helm machinery is that you can buy it as a combination brick and block machinery as well as a brick machine or block machine only. The blocks are made 4x8 inches up to 24 inches long and are faced just as beautifully as the brick. The dry wall two-piece block system produced by the Helm press is a practical method of making and using concrete blocks so buildings will always be dry, constructed cheaper than ever before, yet durable, substantial and beautiful in appearance.

Regardless of your location or experience, you will find the Helm proposition one of those opportunities that build big business and success with the least effort. Write the Helm Brick Machine Co., 593 Mitchell street, Cadillac, Mich., for their new catalog, which gives prices and full particulars concerning their equipment.

Electric Locomotive in Gravel Pit

A 6-ton Goodman electric locomotive operated by trolley, is used by the Wilcox Company of Chicago, in mining 38 acres of gravel deposits at Fontana, Wis. On a haul of 1,000 ft., 90 tons per hour are handled by this locomotive and four Sackett bottom-dump cars. The locomotive hauls two cars to the plant and back while the other two cars are being loaded by the steam shovel.



The Helm Press for Making Concrete Brick.

Quarrying in Winter

By F. H. Gunsolus

During the winter months the cost and difficulties in the operation of quarries are considerably increased. At one time was this especially so in regard to explosives. This increase was brought about by the cost of thawing and the loss of efficiency due to the use of chilled or frozen dynamites.

The number of accidents which have occurred in thawing explosives or in careless handling of frozen explosives has been great, and the damage awards occasioned thereby must be charged to the cost of operation of the plant. Now, however, by the use of low-freezing explosives, it is possible to operate quarries just as efficiently and economically in winter as in summer. It is likely that in former times many plants were obliged to cease operations on account of difficulty with frozen explosives. That day is past. There is no need nor excuse now for this.

It is well known that ordinary nitroglycerin dynamite freezes at about 45 degrees F. and begins to chill at about 50 degrees F. When an explosive is chilled or frozen it becomes less sensitive to detonation, and the breaking strength is much diminished. When used in outside work, as in quarries, a high freezing explosive, even if thawed before using, may become chilled or frozen by contact with the water or cold rock of the bore holes. When this occurs you do not obtain the full power of the explosive. Partial detonation may follow and unexploded dynamite may be left in the bore hole, to be struck by a shovel or pick later on, causing serious trouble.

As in most lines of industrial endeavors, there has been great development in explosive manufacture in the last few years. Not the last step in advance has been the perfection of low—almost non-freezing—nitroglycerin dynamite.

True, it is possible to make explosives which are absolutely non-freezing. This class of explosives, however, does not contain any nitroglycerin and is only adapted for work in a limited field.

Up to date, nothing has yet been discovered in the way of an explosive which equals one of nitroglycerin base, either in shattering or breaking power, stability or regularity.

The writer once heard a quarryman say, "When you take the freeze out of dynamite, you have a mighty poor explosive." While crudely expressed, the meaning here is clear. There is no truth in that statement. It is admitted that in the early attempts in making a low-freezing dynamite such may have been the fact. This idea is now mostly imaginary.

Such people belong to the "single rut, stand pat" class, and never can see any merit in something new or are willing to admit that an improvement can be made in anything. Such was the spirit which animated the mockers of Morse and the telegraph; of those who laughed and ridiculed Langley and Wright. Yet who today would dare criticise the accomplishments of these men?

And so it has been in the explosive field. Progress beyond belief has been made and improvements are constantly being made. We have conducted practical tests in actual work—many of them—and we can state with authority that low-freezing explosives are just as efficient, reliable, and even safer, than the old type of high-freezing ones. Because of the belief that low-freezing dynamites were not as strong as the old type, many quarrymen used this type of explosive only in winter, reverting to the high-freezing kind in summer.

There is no reason now for this alternating, as the present low-freezing dynamite is an "all the year

around" explosive. We know of numerous operations where Du Pont Gelatin and Red Cross Dynamites are used all through the winter and no thawing is required. We cannot state definitely at just what temperature these explosives will freeze. There are many conditions which affect the freezing point of many substances, and so with dynamites. We do know that it is a most extreme and severe condition where it will be found necessary to resort to thawing.

The poet Pope once said: "Be not the first by whom the new is tried, nor yet the last to cast the old aside." Low-freezing explosives have passed the experimental stage. They are an assured success. You won't be the first by any means to adopt them, but if you fail to take advantage of their use, you might run a chance of being placed in the mossback class, and be last.

If your work is being conducted where the temperature goes extremely low, it may be necessary at times to thaw explosives. Low-freezing explosives are easier to thaw and it takes a much longer time for them to freeze.

If you have to build a thawing house and desire any information on explosives, write any of the leading manufacturers. They will send you plans and instructions about this vital matter.

Circular Monolithic Concrete Farm Buildings

No farm is efficiently equipped unless it has a water tank, a milk house and a root cellar. The machine illustrated on this page makes possible all of these three in one. In structure they are one; in operation they are absolutely separate.

The water tank is, of course, placed highest, so that pressure may be obtained for the dairy and for the house, thus giving the house the advantages of a city water system.

The milk house is cool, sanitary and complete. Combining it with the water tank has many obvious advantages.

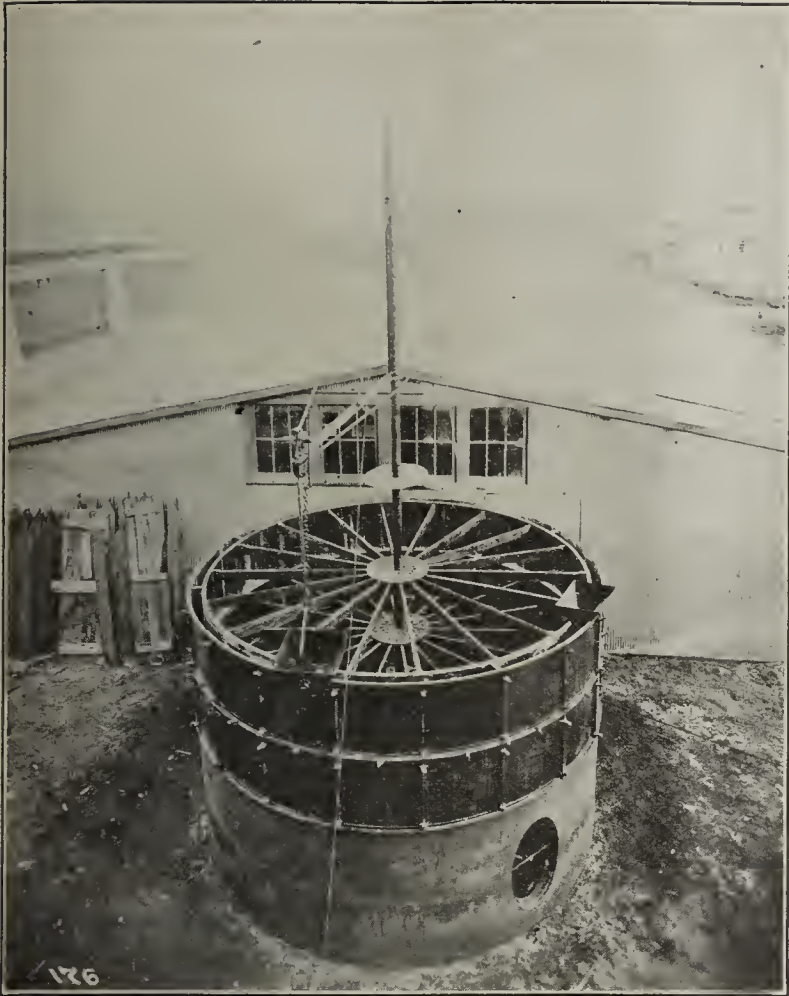
A root cellar is a farm convenience often overlooked. A separate storage for potatoes, turnips, beets, onions, carrots and pumpkins insures against loss and makes for sanitation.

The above three-in-one building is one of the most economical structures possible. It appeals to the good sense and economy of every progressive farmer.

Circular monolithic concrete buildings are rapidly "winning out," because they mean the "most for the money." Circular design gives a maximum of space with a minimum of material. That at once lowers construction costs. Round buildings require less labor to build—another lowering of construction costs. They conserve room, being easily adapted to difficult locations.

Concrete makes it easy to build under ground. It keeps water out or it keeps water in, and it never decays. It makes going to greater heights above ground possible, again conserving space. Concrete is proof against the ravages of time and fire. It keeps out rats and vermin. It needs "never a penny" for repairs. Circular monolithic concrete buildings are substantial and picturesque. They are signs of prosperity and permanence.

The Polk System Junior machine shown herewith has a big program of usefulness in farm building construction. It puts many kinds of circular farm buildings, built for keeps, within easy financial reach of the average farmer. It builds stock tanks, silos, water tanks, corn cribs, cisterns, garages, and well houses at remarkably low cost



The Polk System Junior Machine Builds 4-Inch Wall Monolithic Concrete Silos, Stock Tanks, Water Tanks, Corn Cribs, Cisterns, Garages or Well Houses at Remarkably Low Cost and in Short Time.

and in remarkably short time. The Polk System Junior machine is equipped for the erection of circular monolithic concrete structures 10, 12 and 14 feet in diameter, and up to 40 feet in height, with walls four inches thick. It has been developed with the following purposes in mind: Minimum investment in forms, lowest possible construction costs, ease and simplicity of operation, the erection of flawless structures. The Polk System Junior machine builds three-diametered structures with the same wall forms. It automatically keeps the wall plumb; builds it smooth; provides for accurate placing of re-enforcing bars; gets maximum strength out of minimum material, and so simplifies the building of four-inch wall structures that any intelligent workman can easily construct perfect buildings from the start.

The governing principle of the Polk System Junior machine is a center mast. This center mast is raised on end at the center of the floor of the structure to be built and is carefully plumbed by means of guy wires provided with turn buckles. It is a three-inch steel tube provided with a series of transverse holes to receive a steel pin. On this pin rests a series of steel discs, which in turn support the inner ends of the radial bars. These radial bars control the accuracy of the curvature of the wall, as well as its plumbness.

With the Junior machine two complete sets of wall forms are furnished. Each set consists of twenty-one inside and twenty-two outside separable sections, all uniform and interchangeable. These sections weigh only seventeen pounds each and are twenty-five inches long by twenty-four inches high. They are consequently easy to handle and will build four feet of wall per day. A third set of wall forms equips the machine to build six feet of wall per day, if that rate of progress

is preferred. Each of the form sections is stiffened around the edge by a steel angle frame with welded corners. At their joining ends the form sections are fastened together by means of quick acting clamps. The inner sections being securely attached to the radial bars, curvature and alignment are made sure.

For placing the concrete in between the forms, a V-shaped dumping bucket is provided. This bucket is supported by a crane extending equal distances each side of the center mast, and pivotally attached to the center mast, so that the bucket can be easily swung to any part of the wall space. The bucket is hoisted by means of a rope and a series of pulleys so arranged that the hoisting force is applied from without the structure.

The bucket is hoisted by means of a rope and a crane. A series of pulleys is arranged so that the hoisting force is applied from without the structure, one end of the double crane being used as support for the pulleys controlling the fall line of the hoisting rope. When the bucket is hoisted it is coupled to a carrier on the crane and then swung to any part of the wall desired.

The working platform for the man on top is made by laying boards over the radial bars after the forms are set for a fill.

Write for full information concerning the Polk System Junior machine to Polk-Genung-Polk Company, Fort Branch, Ind., or 706 Fisher Bldg., Chicago.

New Book—"Sewage Disposal"

"Sewage Disposal," is the title of a new book (second edition rewritten) by Leonard P. Kinnicutt, late director, Department of Chemistry, and Professor of Sanitary Chemistry in the Worcester Polytechnic Institute; C. E. A. Winslow, Professor of Public Health in the Yale School of Medicine, and Curator of Public Health in the American Museum of Natural History, New York, and R. Winthrop Pratt, Consulting Engineer, member American Society of Civil Engineers, just issued by John Wiley & Sons, 432 Fourth avenue, New York, N. Y. It is profusely illustrated and contains 547 pages. Price, \$4.00. The table of contents follows:

The Sanitary Demand for Sewerage and Sewage Disposal. Composition of Sewage. Disposal of Sewage by Dilution. Screening and Straining of Sewage. Preliminary Treatment of Sewage by Sedimentation. Preliminary Treatment of Sewage by Chemical Precipitation. Preliminary Treatment of Sewage by the Septic Process. Preliminary Treatment of Sewage in Two-Story Tanks. Disposal of Sewage by Broad Irrigation or Sewage Farming. Disposal of Sewage by Intermittent Filtration Through Sand. Treatment of Sewage in Contact Beds. Treatment of Sewage in Trickling or Percolating Beds. Treatment of Sewage by the Activated Sludge Process. The Disposal of Sewage Sludge. Disinfection of Sewage and Sewage Effluents. Some General Considerations in Regard to the Design and Operation of Sewage Treatment Plants. Disposal of Sewage and Excretal Wastes in the Absence of a Sewerage System. Methods of Testing Sewage and Sewage Effluents.

Olympic Cement Company Is Prepared to Take Part in Tremendous Upward Trend of Business in Coming Years—Fuel System Is Changed Over from Oil to Coal—Future Output to Be Increased

Nineteen hundred nineteen will reopen road building in all parts of the country, calling for unprecedented quantities of cement, Mr. A. F. Krabbe, manager and superintendent of the Olympic Portland Cement Co., Bellingham, Wash., feels certain, and there is every reason, he says, for all lines of building which require cement in construction to start a progressive move early in the year and continue at least over the period of the next two years. In this locality, for example, road building promises to be heavier than ever, even before the slowing down process was made necessary by war measures. This year, unfinished road contracts alone call for nearly fifteen miles of hard surfaced roads and projects now under consideration in all probability will double this mileage. What is true of this section is true of every part of the United States and, Mr. Krabbe points out, cement plants will be called on for tremendous supplies of material, which all plants now are under preparation to fulfill.

In the east, the Postal Department is working out plans for truck delivery of parcels post packages, and before this is practicable, hard surfaced roads will be necessary; in Washington, in addition to the county road building under way or proposed in a program of two or more years, there is a movement growing rapidly in its popularity for the issuing of bonds on the value of automobile licenses to the amount of \$30,000,000 for a network of state roads which will eclipse anything in the way of a road building program ever seen in this country. These projects all call for cement and figure in the prospective big business ahead for these industries. The Olympic cement plant will be ready to have its share of this business as it comes. Just now, during the slack season, the company is operating to place in storage a creditable amount of finished product so that when the real rush begins, there will be no delay in filling orders. A constant stream of cement now is running into the 10,000 barrel storage containers.

When oil as a fuel for industrial plants ceased to be available, the Olympic Portland Cement Company at once made preparations to use coal, and today is equipped with a pulverized coal and at a cost running up into the thousands of dollars. The big kilns now are fed with coal and through a process that would speak economy were it not for the jump in the price of coal in the last eighteen months.

The lowest grade of coal known is used. In fact, it is a product of the mines for many years thrown aside as pure waste and used to form roadways about the mines. Great heaps of this fuel may be seen at any large mine. Now it is a potent factor in the manufacture of cement, as all the big plants of the country, east and west, have turned to coal as fuel.

At the Olympic cement plant it became necessary last year to build first a big storage shed, where 5,000 tons may be placed at a time. The coal is brought up on barges, loaded onto cars by steam shovel and conveyed to the storage plant in the cars. There it is dumped and lifted to the hopper, from which it is carried by elevator to the drying drums. From this point it automatically is sent to the grinders, where it is pulverized to the fineness of wheat flour. Through a blower system the dust then is sent hustling into the kilns, where it finishes its work, creating at the feed

end 3,000 degrees F. heat and up to 1,700 at the far end of the big revolving steel cylinders and wherein the ground raw cement material is sent from the jaws of the big grinders. So furious is the flame and heat that tenders must wear highly darkened glasses, and it is next to impossible to look through the kiln center with the naked eye, not to say anything of being dangerous.

To all who use coal comes the question of ashes and clinkers. Like the core of the apple, there "aint' none," as the ash is dropped into a big drum cooler, where cold air is pumped through it, and it then is sent on to be ground up with clay, being found to contain, chemically, the proportions necessary in the clay for perfect cement material. All that gets away as waste under this pulverized coal burning process is a thin wisp of smoke seen curling from the great smokestacks, and sometimes this barely is visible. The daily consumption of coal is 220 tons.

Featuring the whole plant is the systematic set of operations, by which all materials are handled no more than is absolutely necessary. And in addition is the outstanding feature of the absence of dust either in mill room, coal pulverizing room or other departments. This is due to the suction equipment which takes up and carries to use somewhere all dust.

From the time the raw material is mined and loaded onto cars at Kendall until the sacks of finished product are loaded onto car or boat, no useless handling in any phase of the products occurs.

New Dock Constructed

Last year the company rebuilt its ocean dock. It now is entirely new and of creosoted piling calculated to last 20 years against the life of five years of the old dock. The new dock is 2,400 feet in length, made possible because oil tankers no longer need to dock for discharging fuel. The new dock does not reach as deep water, but sufficient for all purposes. The old dock was 3,000 feet long.

Several weeks of last year found the plant idle, because of the change necessary in the fuel system. About 75 per cent of the output of 1916 and 1917 was possible in 1918. Government restrictions also contributed to this condition.

At that, the plant turned out 200,000 barrels, or 800,000 sacks, in 1918. Practically all this stock had been shipped when the plant reopened the first of this month. An average of 70 men are employed at the plant and quarry. Wages for these employees have increased by an average of 50 per cent in the last year. The company has maintained a monthly payroll of \$8,000, and in addition has distributed for supplies and the like a large amount.

Coal Plant Big in Itself

One of the substantial buildings erected this year is the big coal pulverizing plant, a part of the system installed when the end came to using oil for fuel. This building is of reinforced concrete and much of its equipment is of cement construction, including great hoppers and bins into which the coal must go. The supporting pillars for the big coal shed, on which rests the roof high enough to permit a big hoisting crane to operate, are of concrete, as is the projecting portion of the roof.



Quarry Scene in Texas—The Texas Trap Rock Co.

Rock Quarrying for Cement Manufacturing

A most important service has been rendered the stone industry of the entire country by the series of handbooks on quarrying and other kindred technical subjects issued by the Bureau of Mines, Department of the Interior. These are written by experts of wide experience, and they contain invaluable suggestions and directions that can be found in no other form. It is such wise governmental fostering as this that is largely responsible for the phenomenal growth of our industries. In other countries work of this nature is left entirely to private initiative. The latest one of these handbooks to be put forth by the bureau is "Rock Quarrying for Cement Manufacture," by Oliver Bowles.

With regard to the factors governing the plan of quarrying, Mr. Bowles says:

"The plan of quarry development that will give the best results is governed by the depth of stripping, the thickness and attitude of the beds, the structure of the rock, and the uniformity of its chemical composition in the same and in successive beds.

"If the overburden is thick, deep quarrying should be pursued if conditions will permit, for thus the maximum quantity of rock is obtained for a minimum of stripped surface. If the good rock is not thick enough to make deep excavation possible, cheap methods of stripping must be employed to make quarrying profitable. Where the overburden is thin and a great

thickness of rock is available, the depth to which the quarry may be worked is a matter of choice. The quarryman should seek to develop a quarry face of the height that can be worked the most cheaply. Usually a face thirty feet high or higher is more cheaply quarried than one less than thirty feet in height.

"If the beds are flat, the direction of the quarry walls is influenced only by surface contour, by structural features, such as joint planes, or by the most convenient situation for transportation lines. However, for steeply inclined beds it is usually better to make the quarry face at right angles to the strike of the beds and thus cut across successive strata. When the face is in this direction the rock is more easily blasted and a more uniform mixture is obtained.

"Every quarry plan is influenced more or less by drainage conditions. If a large flow of water is encountered, automatic drainage at a high level, leaving sufficient rock face above water level, would discourage deep quarrying which involved excessive pumping.

"In beds dipping at a low angle, it is usually wise to quarry in such a manner that the face is moved up the dip. By this method drainage from the face is insured, the rock is thrown down and loaded more easily than when worked in the opposite direction, and the loaded cars may be partly or entirely moved by gravity.

"In choosing a suitable level for a bench or quarry floor in a rock deposit where the beds are approximately horizontal, the operator should be governed

chiefly by the position of open bedding planes. Such planes promote effective blasting and also make a smooth floor, which greatly simplifies the laying of tracks and the loading of rock.

"Where the strata are extremely folded and contorted with synclines, anticlines and faults, the process of quarrying may be more complicated. Especially is this the case where dolomite and limestone are interbedded, as in a certain Georgia quarry. In that quarry the beds are folded, have irregular axes, and the structure is complicated by faults. The dolomite, in general, forms the axes of the anticlines and is interbedded with the limestone at various levels. It is a difficult matter to quarry this rock in such a way as to avoid the dolomite. The method used is, in general, to maintain a quarry face at right angles to the axes of the folds and to work out the synclines. The dolomite, however, occurs in many unexpected places, and the problem is therefore beset with many uncertainties. The writer is confident that working out of the structural relations of the dolomite and the limestone by a competent geologist, and careful mapping of the quarry area would be of immense value to the company. Cross sections showing the relation of the dolomite to the limestone and the position and throw of faults would be of especial value. At many quarries geologic study and the careful preparation of maps would probably be of great help in laying out and developing the quarry. In such investigations emphasis should be placed on the relation of good rock to impure rock. As far as practicable, the position of each in the deposit should be ascertained in order that a plan of development may be worked out by which the good rock may be obtained and the defective material avoided."

As to stripping, Mr. Bowles says: "Stripping or removal of overburden is a very variable factor in quarrying. Some deposits are exposed and no stripping is necessary. In other places the removal of 40 to 50 feet of cover may be necessary, whereas a depth in excess of 50 feet is common. As a rule, no attempt is made to remove such excessive overburden. The rock deposit is either classed as unavailable or tunnel methods of quarrying may be employed.

"The overburden may consist of clay, sand, gravel, or a mixture of these substances, and may contain boulders of various sizes. It may be soft and easily excavated by hand or with a steam shovel, or it may be so hard that blasting is necessary. All these factors must be considered in determining the best means of removal.

"The chemical composition of the overburden is of considerable importance. If the underlying rock is a high-calcium limestone requiring the addition of clay or shale, it is possible that the overburden may be used as a constituent of the raw mix. Under such conditions stripping may not be necessary. Instances have been observed where a depth of two to four feet of clay or weathered shale is not removed from the rock surface, but is shot down and loaded with the rock. There are two objections to this process which condemn it in the minds of some operators. First, in wet weather the clay makes the rock muddy and difficult to handle and crush, particularly where gyratory crushers are employed. In the second place, the presence of large quantities of clay, which are often imperfectly mixed with the rock, makes it difficult for the chemist to maintain a uniform mixture.

"It is doubtful whether shooting down a thickness of two to four feet of clay with the rock is advisable. However, the fact that clay is one of the constituents commonly added to limestone to make cement obviates

the necessity for clean stripping in many places, and thus relieves the quarryman of an operation which is usually tedious and costly.

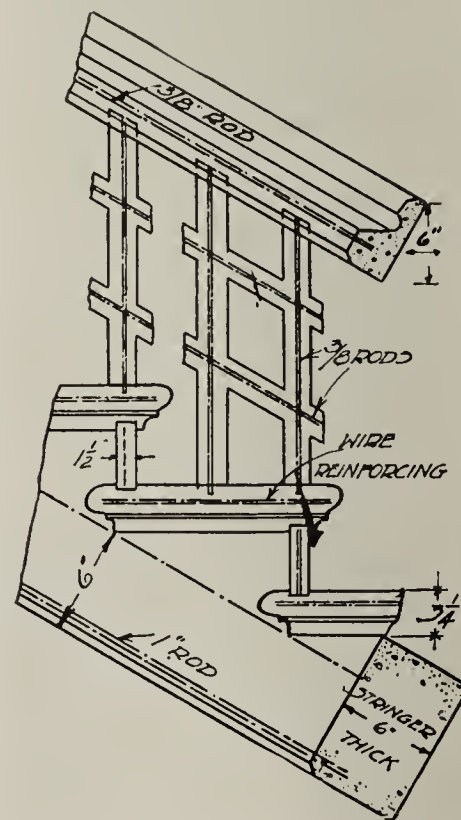
"Where the depth of overburden varies in different parts of the quarry, the feasibility of shooting down the overburden with the rock depends to some extent on the method of quarrying. In one Kansas quarry the overburden varies in thickness in different parts of the quarry from a few inches to ten feet. At one time the overburden was shot down with the rock. Hand loading methods were then employed, and while some cars were loaded with an excessive amount of earth, others from that part of the quarry where the overburden was thin were loaded almost entirely with rock. By sending the cars to the crusher in proper order a uniform mix was maintained. Later a steam shovel was introduced for loading rock in the quarry, hence the rock could be taken only from one part of the quarry at one time. If the overburden at that place was thick the proportion of clay loaded with the rock would be altogether too high. Therefore it was found necessary to put another steam shovel on the surface and strip the rock mass. Rock quarried from all parts of the face was then relatively free from clay, the necessary amount of clay or shale being added at the cement plant.

"Where it is desired to use the rock without admixture with stripping, the surface should be stripped back far enough from the face to prevent masses slipping into the pit. An instance was observed where soil had slipped into the quarry and was later removed by the slow and tedious hand shovel and dump cart method. It is much better to employ the most efficient stripping means possible, and to strip a fairly wide surface ahead of rock quarrying operations."

Mr. Bowles' suggestions as to methods of stripping are practical and helpful for all quarrymen.

Steps of Concrete

Steps of reinforced concrete were erected at the Lanark, Ont., Presbyterian church, by William M. Connors. Treads and risers were molded separately, reinforced with web 2 inches by 4 inches mesh, electric welded No. 9 wire.



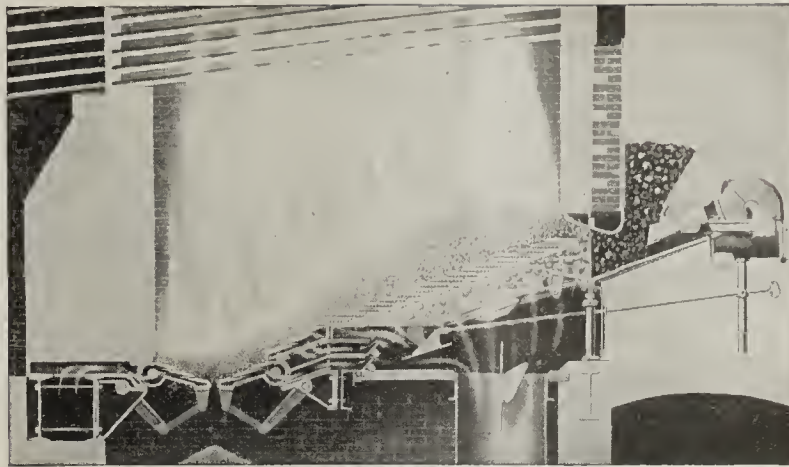
DETAIL OF STEPS AND RAIL

They are 9 feet wide set up on four sets of string forms reinforced with 1 inch square bar-steel running through platform beams into stone wall. The platform is reinforced with the same wire as the steps and the risers. Newels are reinforced with a cage of mesh reinforcing like that in treads cast hollow with recess at bottom connecting string riser and step. Strings and platform were poured. Balusters were cast in wood forms reinforced by $\frac{3}{8}$ -inch rods, projecting out of ends to fit holes cast in the treads. Rails were reinforced with two $\frac{3}{8}$ -inch rods connecting with a $\frac{3}{8}$ -inch rod projecting from each newel, and a cavity was left in the newels to connect the concrete of rails. This job was wanted in a hurry and it was necessary to make three step forms, six baluster forms and two rail forms, two newel forms—one full and one half. All molds made of wood and shellacked for each cast.

The Old Order Changeth

Yesterday, the fireman in the power house opened the ash pit door, let in a blast of air, threw in more coal, the steam gauge popped, and the necessary power was generated. The waste of fuel even though enormous was incidental to "keeping up the steam." To-day, to conserve the coal pile, and do it by eliminating wasted heat and providing facilities for proper combustion is of primary importance.

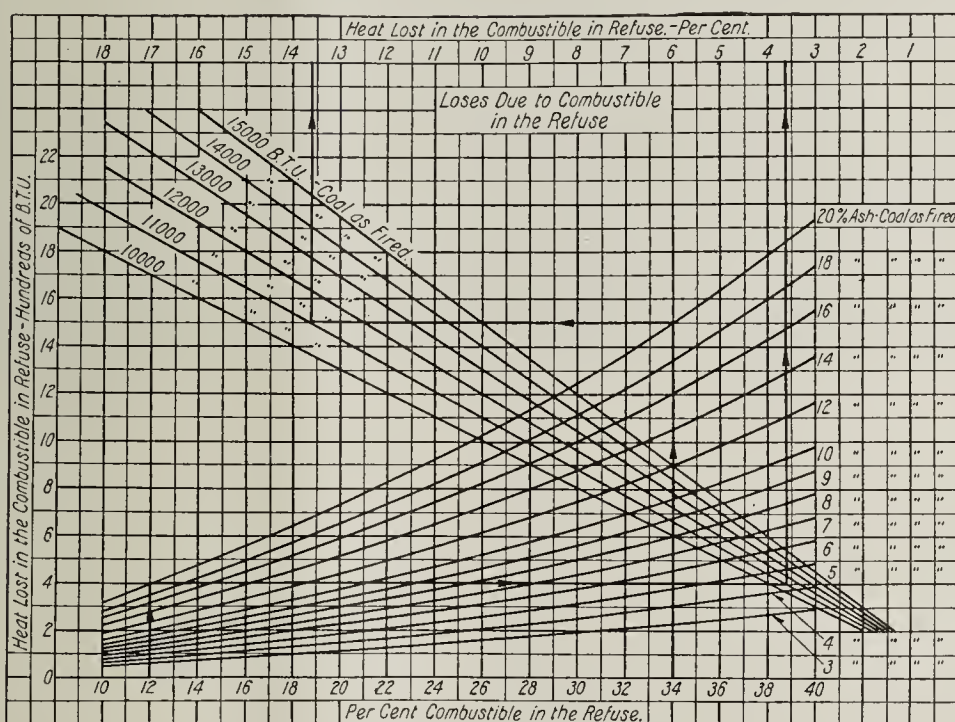
A correct amount of air distributed evenly to the fuel bed certainly goes a long ways toward eliminating



Westinghouse Underfeed Stoker Showing System of Distribution.

pleted. These rows of tuyeres, extending in the same direction as the coal retorts, resemble a string of overlapping sea shells. They are corrugated, the openings at their edges forming vents for the admission of air to the burning coal.

The tuyeres are set on wind boxes connected with the wind boxes. The air openings are graduated from the nose of the tuyere to the sides. As a result the whole surface of the fuel bed is constantly fed with minute jets of air, regulated so that the exact amount is always supplied. This possibility of mechanically regulating the amount of air admitted is no mean ad-



Photograph Showing Loss Due to Combustion in the Refuse.

waste. A system for controlling the admission of air to the fuel bed is provided with the installation of a Westinghouse Underfeed Stoker.

No air is admitted to the fuel bed except that which is supplied by a forced draft fan. The air is forced first through a main air shaft to several wind boxes located beneath the fuel bed. These in turn distribute the air in correct amounts to the fuel bed.

The surface of the fuel bed itself is constructed purposely to facilitate this distribution. Coal troughs convey the fresh coal from the hoppers at the front of the furnace. These troughs are inclined and extend nearly to the rear dumping grates. The fresh coal on its way down the retorts is heated to such a degree that the volatile substances are distilled; then it is forced upwards upon the tuyeres where combustion is com-

pleted. Beyond the farthest extension of the rows of tuyeres is a short fuel bed provided with a corrugated surface, which also admits air to the fire from ducts directly connected to the main wind box.

To utilize carbon that often goes into the ash through the front dumping grates, special auxiliary air ducts supply air directly to these grates, thereby burning this carbon before it is dumped into the ash pit.

Very frequently it is necessary to furnish air to the fire above the fuel bed. This contingency is met by the Westinghouse Underfeed Stoker by air cooled boxes at the front used to support the front wall and also available for an over air supply.

Each one of these fields of distributions: through the tuyeres, the corrugated grate, the dumping grates, and the front air cooled boxes is regulated by a system of dampers adjustable from the front on the side of the furnace. This means that the fireman is more inclined to make use of them than if they were, as they often are, located in the rear of the furnace. Dampers can be so set that with a thin fuel bed, the air to the lower part of the furnace can be completely shut off.



Westinghouse Patented Tuyeres, Showing Opening for Air Distribution.

When high capacity is desired, air to the lower part of the furnace, and the dumping grates, can be admitted making the entire grate surface fuel supporting and air admitting.

The specific results obtained from the system are: a large range of adjustment, saving carbon in the ash; high CO_2 prevention of smoke due to imperfect combustion, flexibility for high peak loads, no clogging of grates, adaptability to different sizes of coal, and a saving of one-quarter of the coal pile.

Wear Tests of Concrete*

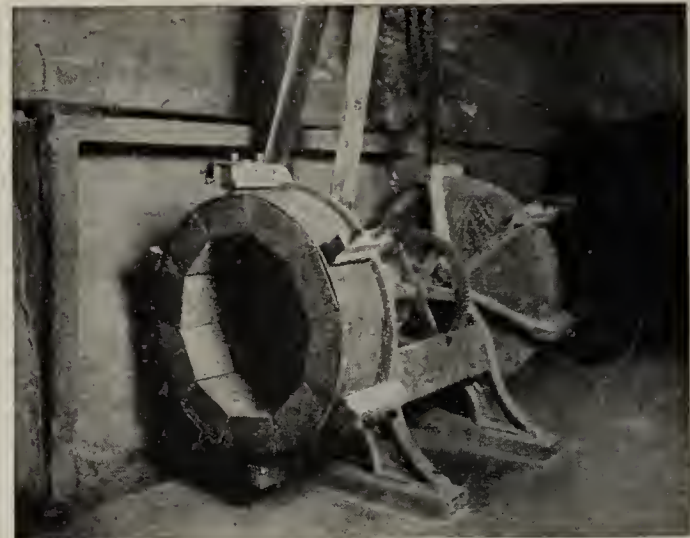
Concrete is widely used in the construction of floors, pavements, walks, loading platforms, and for other purposes requiring high resistance to impact and abrasive stresses. Such uses of concrete have emphasized the necessity for more complete information concerning the factors which affect the wearing resistance of the material. This information is being secured by means of experimental studies in progress at the Structural Materials Research work on the properties of concrete and concrete materials being carried out jointly by the Portland Cement Association and Lewis Institute. Several thousand wear tests have been made during the past three years; other studies of a similar kind are now under way.

With cement meeting standard specifications and high-grade aggregate, mixed in definite proportions, the maximum resistance to wear can be secured by the following methods:

- (1) Reduce the mixing water to the smallest quantity which will produce a workable concrete;
- (2) Provide proper curing conditions so that concrete will not dry out too soon or be injured by traffic before thoroughly hardened;
- (3) Thoroughly mix the concrete.

Too much emphasis cannot be placed on the fundamental importance of proper control of mixing water. In many instances a large proportion of the cement is simply wasted, due to the use of too much water in the concrete. Tests made in this Laboratory have shown that in a 1-sack batch each pint of water more than necessary lowers the strength of the concrete and its resistance to wear, the same as if we should omit 2 or 3 pounds of cement. The "sloppy" mixes frequently seen in floor and

*By Duff A. Abrams, Professor in Charge, Structural Materials Research Laboratory, Lewis Institute, Chicago.



Talbot-Jones Rattler with Concrete Wear Blocks in Place.

road construction may give concrete of less than one-half the strength and resistance to wear that should be secured at the same cost if proper care were given to proportioning the water.

It is impracticable to state in general terms the exact quantity of mixing water which should be used, since this depends on several factors, such as quantity of cement, kind, size and grading of aggregate, moisture contained in aggregate, etc. For the mix generally recommended for use in road construction, that is, 1 volume of cement to about 4 volumes of mixed aggregate (aggregate graded up to $1\frac{1}{2}$ or 2 inches), the water necessary to produce a workable mix will vary from $5\frac{1}{2}$ to 6 gallons for each sack of cement. Other factors being the same, the full utilization of the cement in the concrete depends entirely on the use of the smallest quantity of mixing water which will produce a concrete of satisfactory plasticity.

Increasing the quantity of cement in the concrete or improving the grading of aggregates is effective in increasing the resistance to wear only in so far as we are enabled thereby to reduce the quantity of water as compared with the cement in the mix.

Ample moisture during the curing period is second in importance only to the use of a proper quantity of mixing water. The tests show that unfavorable curing conditions produce exactly the same effect as too much mixing water. However, the former factor is not at present subject to the same abuse as the latter. Many floor jobs are ruined due to failure to supply moisture for a few days after placing the concrete. The "ponding" method furnishes ideal conditions for the curing of floors and roads. A good rule to follow is: "Mix with the smallest quantity of water that will produce a plastic concrete, then supply as much water as possible for curing."

Traffic should be excluded until the concrete is thoroughly hardened; the length of time required will depend on the nature of the work and the weather. Not less than one week should be allowed for curing in any case; for roads for vehicular traffic this time should be extended to 10 days or 2 weeks; under unfavorable conditions one month or longer may be necessary.

The concrete should be mixed in a batch mixer for a full minute after all materials are in the drum. The resistance to wear is materially lowered by undermixing. There is no danger that concrete will be mixed too long. However, it has been clearly shown that no reasonable increase in the mixing period will counteract the ill effects of too much mixing water.

Wear tests of concrete were made in the Talbot-Jones rattler. The test pieces consist of blocks 8 inches square and 5 inches thick. The blocks are arranged around the

perimeter of the drum of the rattler; the ten-side polygon formed by the test blocks presents a nearly continuous surface. The outside diameter of the polygon is 36 inches and the inside diameter is 26 inches. During the test the front of the chamber is closed by means of a steel plate. The abrasive charge consists of 200 pounds of cast-iron balls (about 133, $1\frac{7}{8}$ inches and 10, $3\frac{3}{4}$ inches in diameter).

The test consists of exposing the inner face of the concrete blocks to the wearing action of the abrasive charge for 1,800 revolutions of the drum at the rate of 30 r. p. m. The machine is run for 900 revolutions in one direction, then reversed. Duplicate rattler heads enable us to test two sets of blocks at the same time. For research work in studying the effects of varying the proportions and consistency of the concrete, each block is

Care of Conveyor Belts

The life of a conveyor belt can be greatly prolonged if adequate attention is given to the belt, the idlers and the general operating conditions.

If the idlers are not kept thoroughly lubricated they will not turn freely, and will cause undue abrasion on the bottom rubber cover and additional strain in the duck.

It is always advisable to install a decking or covering between the troughing and return idlers, for, without it, a piece of material falling from the upper strand of belt may be carried by the lower strand to the end pulley, and there squeezed between the pulley and the belt. A puncture in the rubber cover may result, and moisture penetrating the opening will rot the duck. If this happens, the only remedy is to cut away that section of the belt



Typical Wear Blocks After Test.

made from a small batch of hand-mixed concrete. The specimens are molded in metal forms and finished with a wood float. Each block is weighed immediately before and after testing. The loss in weight is used as a measure of the wear. This loss is reduced to an equivalent depth of wear in inches.

Tests are now under way which are expected to bring out the relative merits of different aggregates for use in the construction of concrete floors, walks and roads.

Standard Cement Meeting

At the annual meeting of the Standard Portland Cement Corporation, San Francisco, Calif., held recently, the following directors were re-elected: George T. Cameron, C. E. Green, Wellington Gregg, Jr., W. R. Berry and A. F. Morrison. The directors then convened and re-elected the officers for the ensuing year, headed by George T. Cameron, president.

At the meeting of the stockholders, President Cameron submitted a financial exhibit showing that the company possessed today more than \$400,000 of liquid assets, such as cash, Liberty bonds, etc.

and splice in a new piece, and this must be done as soon as possible. If the decking is not kept clean, a piece of material wedged between an idler pulley and the decking may prevent the idler pulley from revolving and will cause abrasion of the belt.

Skirtboards and chutes must be so designed and supported that under no circumstances will they touch the belt. If the chute places the load on one side of the belt, the belt will tend to run sideways. The same thing happens when the idlers are not lined up true and perfectly square. This necessitates the use of guide idlers, and these will sooner or later wear away the edge of the belt.

Where large pieces of material are handled it is necessary to see that the plunge from the chute to the belt is not too great, as this tends to wear away the rubber cover of the belt.

It is advisable to go over the belt carefully about once a week and examine it for cuts or abrasions in the cover. These should be cleaned out thoroughly, first, with a rubber cement. This protects the canvas body and prolongs the life of the belt, especially where moist material is handled. When the ends of the belt are fastened together it is advisable to use this cement.

In selecting a belt, the size, width and speed of the conveyor should be made proportionate to the size of the

material carried, the tonnage handled, and the length and lift of the conveyor. When all these points are not duly considered the belt cannot give full service. It must be realized that large sized material cannot be carried on a narrow belt even if the tonnage is small.

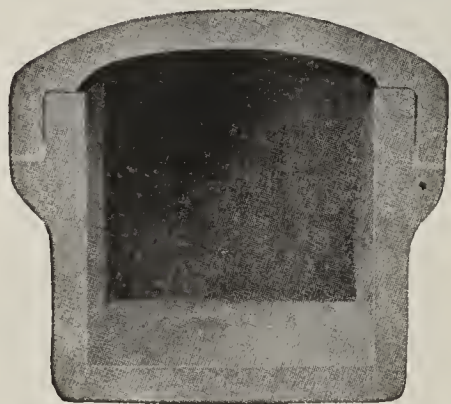
Many concerns have fallen into the bad habit of buying conveyor belts in roll lots, and using the same thickness of belt on conveyors of different lengths. This is a bad practice from an economical standpoint. Short conveyors require less numbers of plies than longer conveyors, width and load being constant. The number of plies should be based on the strain or horsepower pull, of which the length is one of the determining factors. Consequently, to use more plies than needed is a waste of material and money.

Belts should not be run tighter than is necessary to prevent slipping. An overtight belt wears out rapidly. Anything under tension, a piece of twine for example, is cut more easily when tight.

Concrete Burial Vaults

The demand and search for a suitable burial receptacle is centuries old. Every human being desires and aims to properly care for the remains of their dead and each of these beings has an inborn dread of the very thought that the remains are not in a permanent, dry and vermin proof resting place.

The old wood box that rots and crushes is a failure. The life of metal depending almost entirely upon the chemical condition of the earth in which it is placed, and the life of a metal vault is only lengthened when the vault is placed in position to escape the known destroyer of metal, water. Vaults made of brick freeze in cold weather, and those made of stone slabs, slate or even con-



The Automatic Seal is the only Permanent Seal. Cement Alone Will Not Make a Dependable Seal. The Cover Must Fit Over the Vault Body the Automatic Way.

crete blocks that form a vault by holding up the earth, but they are not water or vermin proof. This is the reason why the monolithic concrete vaults that are made from molds manufactured by the Automatic Sealing Vault Co., 216 East River street, Peru, Ind., is the first and only complete relief from that universal dread of the temporary receptacles.

The Automatic Sealing Burial Vault is the very best sectional burial vault manufactured today and manufactured at a price where vaults cannot be considered a luxury.

The manufacture of concrete burial vaults pay big profits—from \$15 to \$25 on each one. You can develop this as a side line or devote all your time to it. There is a constant demand the year round.

Some Things the Contractor Often Overlooks

By William F. Hildeman, Contractor, Chicago Heights, Ill.

Until a short time ago overhead expense was something that the average business man thought he need not know anything about, and there are few lines of business that have not suffered at some time from the ravages of this unrecognized messenger of gloom.

When estimating on concrete highways it is proper to give attention to unexpected costs with which every job is more or less burdened. Let's start at the beginning and work through. Perhaps we can find some of the oversights that are frequently responsible for our coming out at the small end of the horn when the job is finished.

With the contract in your pocket, bond filed to cover, have you figured the interest on cost of check and cost of bond?

You ship machinery somewhere near the starting point of the job and when you expect it to arrive, your superintendent and a couple of your regular men are there waiting for it. Railroad fare, board and room, and freight bills start at this time.

The equipment arrives—some part is broken or damaged in transit. Another delay until either the local blacksmith can make the necessary repairs or new parts may be brought from somewhere in America—with cost of board and room and other expensive elements going on as usual.

Next is either a camping outfit or some means of conveyance to get men back and forth from the job. Oil, gasoline, tire, and many kinds of repair expenses are, among things, in order. A night watchman, a man at the pumping house to keep the water coming through the roller or mixer have to be considered.

Telephone bills are incurred daily to keep material coming. Few days of rainy weather are scattered here and there throughout the period of the job. Roads are muddy; demurrage puts a blot on the profit side of the ledger. Either these, or no material at all, and regular men of the crew drawing their salary in the meantime.

Just as you are getting a good start, something happens with some part of the mechanical equipment. Flues commence to leak, possibly because of the quality of water you had to use. As there is no chance to send the gang home, you start in to work on the shoulders. Progress is slow, however, for most concreting gangs do not like building road shoulders, and as the concrete laid will not permit use of a wheeler or scraper, you are up against it.

About this time the party owning a water hole, from which you are getting your supply, wants pay for the water with chances that he wants as much for it as you are expecting in profit on the job. Never use a farmer's well until you have made a written agreement covering its use, knowing whether or not it is going to cost you something and how much.

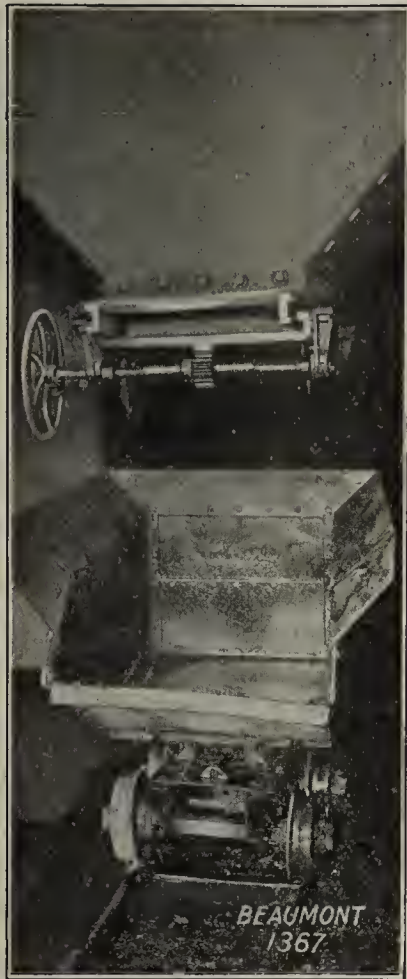
Then there are those numerous things that can be grouped in no other way than by calling them incidentals. They all show up on every job and they all cost money.

We have depreciation, too. Isn't it a fact that we fool ourselves on this very important question? There seems to be a very large difference of opinion among road builders as to the amount to be charged for depreciation of road-building machinery and this is one of the real reasons why many contractors lose out financially in concrete road building.

Another important item that must not be overlooked is interest on balance held over from fall to spring on incomplete jobs. This is a very important expense for a contractor with limited capital.

The foregoing are merely a few reminders. Nevertheless, they are sure to be on almost every job. Are you sure that every time you bid you give them proper consideration?

Rack and Pinion Slide Gate



Particularly suitable for bottom dump hoppers when material contains large lumps.

This type of gate should be used only in connection with a large collecting car.

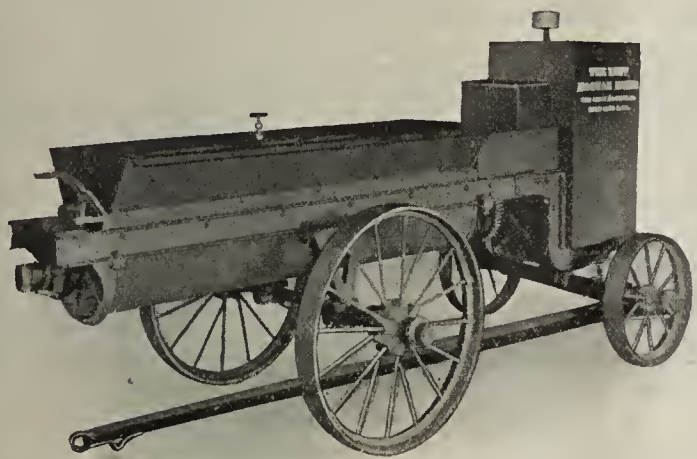
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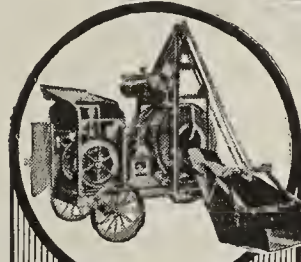
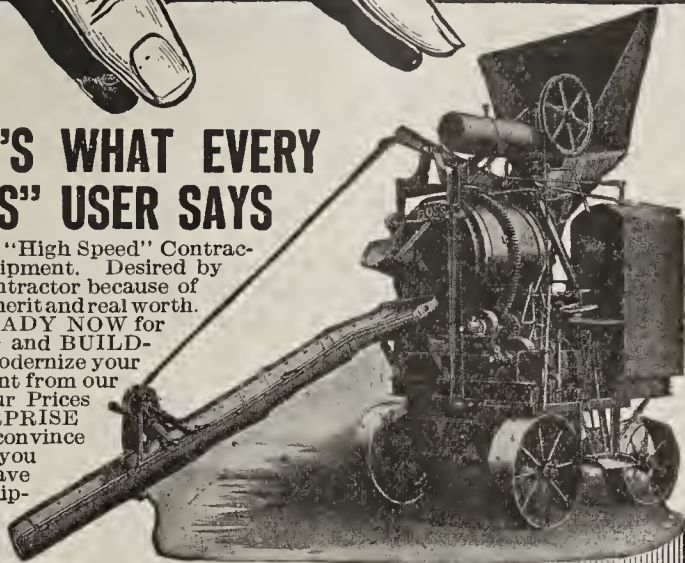
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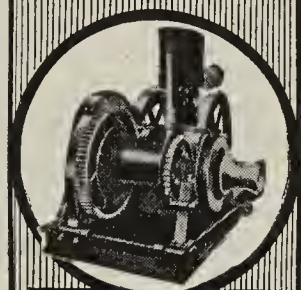


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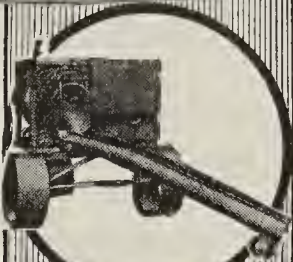
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Building Mixers

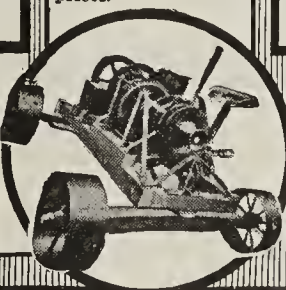
All types, the fastest made, labor saving, low charging; 1/2, 1 and 2 bag capacity.

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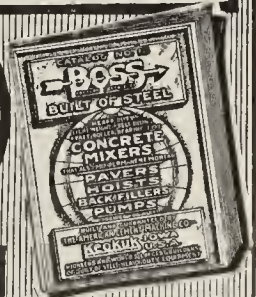
Heavy duty, speedy, durable; \$5 to \$10 per day cheaper in operation. Over 30 carloads purchased by U. S. for use in France. Get our prices.



LOW CHARGERS
\$250 complete. 1/2 and 1 bag.



BACKFILLER
Does work of 10 men.



Get Our Low 1919 Prices

Don't wait. Investigate the Boss line now while we can fill orders. Address nearest office.

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THE 300,000 HP. ELECTRIC CITY

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Accepted as standard by engineers in every state. Used and recommended by road builders and contractors everywhere. Save labor and money and speed up work in construction of sewers, culverts, flumes, drains, tiles and all such work. Made in standard sizes as required by state highway commissioners.

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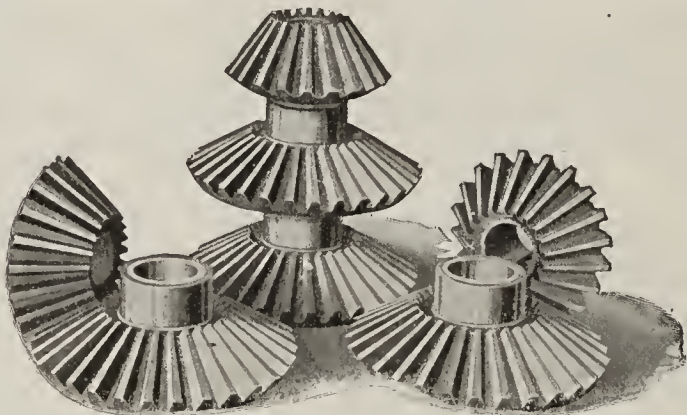
Northwestern Steel & Iron Works

Eau Claire, Wisconsin



PULVERIZED COAL EQUIPMENT

AERO PULVERIZER CO., 120 BROADWAY, N.Y.



Make Your Gear Service a Certainty

Ganschow Bevel Cut Gears—like Ganschow Gears of every kind—are cut with an accuracy and precision which makes smooth, easy, effective working a certainty. They minimize wear and tear and insure long life to the parts. From twenty to forty per cent less power is required to operate

Ganschow Cut Gears

as compared with cast gears, because of evenly-thick and evenly-spaced teeth, and because they are uniformly smooth. Throughout the whole machine the jar and strain are greatly reduced; and this means gear-efficiency from every standpoint.

As specialists in gear work, our splendid facilities enable us to take care of any requirement from the smallest gear up to 12 ft. in diameter—and do it QUICK. Every gear strictly according to specifications and free from defects.

How about YOUR gear requirements?

Wm. Ganschow Company, Chicago, Ill.

1003 W. Washington Street

Henry Heil Chemical Company

210 to 214 South Fourth Street, ST. LOUIS, MO.

We make a specialty of
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**Pyrometers, Calorimeters
High Grade Goods Only**

Satisfaction Guaranteed

BECAUSE WE SPECIALIZE ON Lock Seam Pipe

with the smooth
inside surface,
having already
furnished large quantities for Potash Recovery plants, we
are able to give especially careful attention to the construction of this class of Pipe.

Robertson Bros. Mfg. Co., Chicago

WEBER REINFORCED CONCRETE CHIMNEYS

Coniform and Cylindrical Types

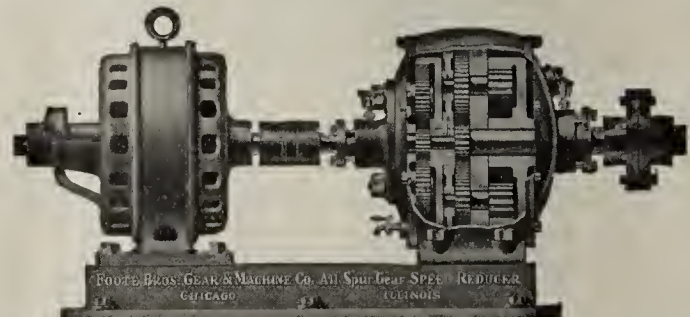
Hundreds In Use

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CHICAGO, ILL.



SPUR GEAR SPEED REDUCERS

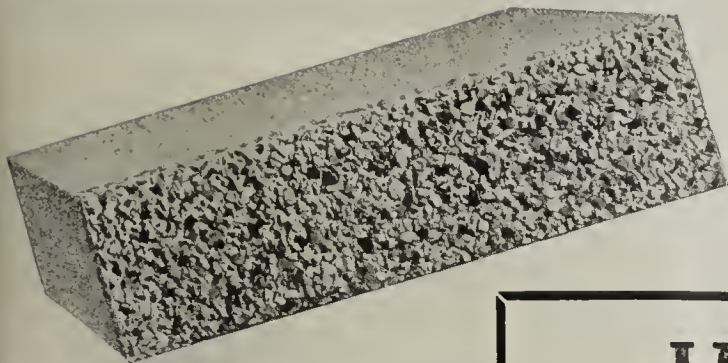
Note they are dust proof, compact, made in any horse power or reduction. Just what is needed on conveyors, elevators and reduction of speed anywhere. We manufacture cut gears. Send for catalogue.

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The Improvement of a World Necessity

Do not overlook the opportunity
and profit it offers you.



Helm Granite Brick

Granite Faced Helm Brick

Helm pressed cement brick are faced with nature rock facings more beautiful than any clay faced brick on the market. These facings include granite, marble, feldspar, mica and other crystalline aggregates. Also with permanent mineral colors in reds, browns, buffs and other tints. The process is so simple expert labor is not required.

The manufacture of brick is as old as civilization—the demand for brick is as certain as day and night. Practically every building means a brick sale—the total brick business in your locality is large and profitable.

Make Helm brick and people will buy more brick from you than from anyone else—because Helm brick (plain or faced) is an improved brick. It is stronger, more durable, faster to lay and better looking.

There is not a better business opportunity open in your town than the manufacture of Helm brick, and we assure you that you can easily make it a success. It is simply a matter of your making the start.



FREE BOOK

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It will not obligate you a penny's worth to let us show you the advantages of Helm brick and the large profits that are being made in its manufacture. Let us go into the matter with you very carefully.

The Helm Brick Machine Co.

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**Helm Machines
for \$25 and Up.
Capacity to 15,000
Brick per
Day.**

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Gentlemen:—Please send me full particulars about the Helm Brick and Block Press and the Products it makes.

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Cement and Hydrated Lime Plants a Specialty

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IT GETS ALL THE BUSINESS —

The POLK SYSTEM JUNIOR machine builds four-inch-wall monolithic concrete silos at dollar-for-dollar competition with any commercial silo—even Oregon fir wood stave.

It also builds stock tanks, water tanks, corn cribs, cisterns, garages, and well houses at remarkably low cost and in remarkably short time.

The four-inch wall means a saving of one-third in material over the customary six-inch wall. The POLK SYSTEM JUNIOR is low in initial cost and low in cost of operation. It builds practically everything that is needed on the farm.

You can get *all* the business with the POLK SYSTEM JUNIOR. Write today for full information.

POLK, GENUNG, POLK COMPANY

706 Fisher Building
CHICAGO

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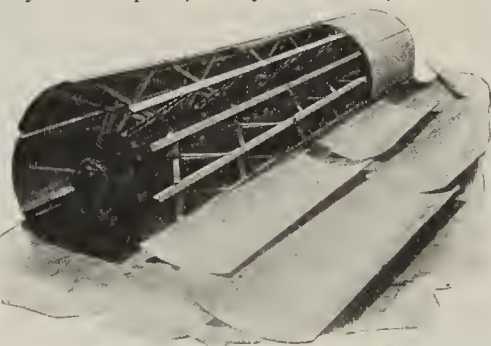
'HIPCO' Culvert Form

Adjustable to 39 different diameters, of any and all lengths. Easily portable, quickly set in place, easily withdrawn, nests in small storage space, cuts concrete culvert costs wherever used. Roller bearings—nothing complicated.

Write for catalog and prices.

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Products Co.

Ligonier, Indiana



CALDWELL'S HELICOID

HELICOID Screw Conveyor is heavier, stronger and better made than any other. Requires fewer repairs—no lapped and riveted joints to come apart—flight all one piece. Special hangers, bearings and boxes for cement work. If you have anything to do with the manufacture of cement, you should write for our Catalogue.

Elevating, Conveying and Power Transmitting Machinery.

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DALLAS, TEXAS, 711 Main St.



Drain Tile Sales Will be Larger Than Ever

The farmer is urged to still greater crop production; not a square foot of land can be left uncultivated. A huge amount of drainage will mark next year's activities; drain tile will be at a premium.

Every concrete products plant should get in shape to handle the biggest spring business in drain tile ever known. Almost every plant is capable of making tile at very little additional outlay. We post you on manufacturing and furnish all equipment.

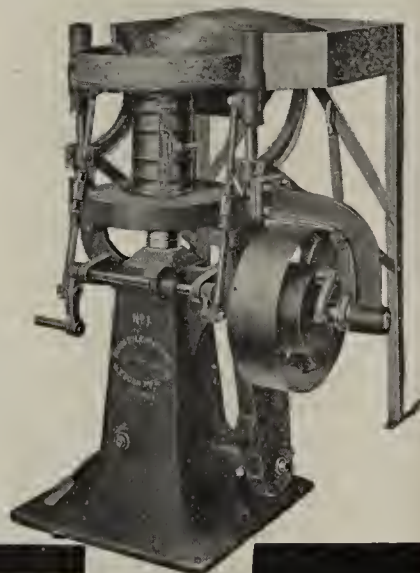
Dunn—the Standard Machine

Ninety per cent of high grade tile is made on the Dunn machine, because it absolutely guarantees a strong, lasting and superior product. Double packing and double troweling are features only of tile that are Dunn-made. Easily better than clay tile, and can be sold in competition with it.

The Dunn machine makes manufacturing easy and highly profitable, and is sold at a lower price than any other machine of its capacity. Write for bulletins on the machine and the business.

W. E. Dunn Mfg. Co.
414 24th Street

HOLLAND, MICH.



Load and Unload

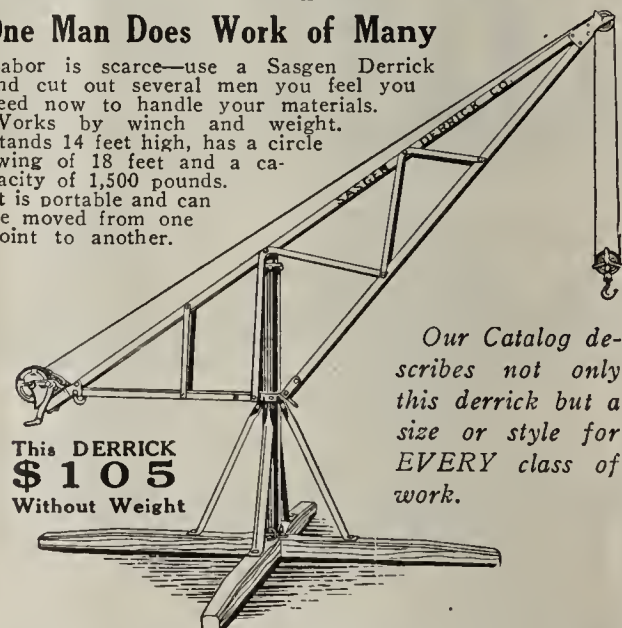
With a Sasgen Portable Derrick

The Sasgen Circle Swing Counterweight Derrick cuts costs, labor and time loading or unloading material from cars or wagons.

One Man Does Work of Many

Labor is scarce—use a Sasgen Derrick and cut out several men you feel you need now to handle your materials.

Works by winch and weight. Stands 14 feet high, has a circle swing of 18 feet and a capacity of 1,500 pounds. It is portable and can be moved from one point to another.



This DERRICK
\$105
Without Weight

Our Catalog describes not only this derrick but a size or style for EVERY class of work.

Sasgen Derrick Co., 3117 W. Grand Ave., Chicago



American Ring Pulverizer LIME-STONE FOR THE FARMER

Make money out of your waste pile. One ton of limestone dust sells for \$1.50 to \$2.00 f. o. b. plant. Cost of production 15 to 30 cents per ton. The patented American

Ring Pulverizer is doing it. Our friends made thousands of dollars out of material that had to be dumped before—to the benefit of the farmer and Uncle Sam.

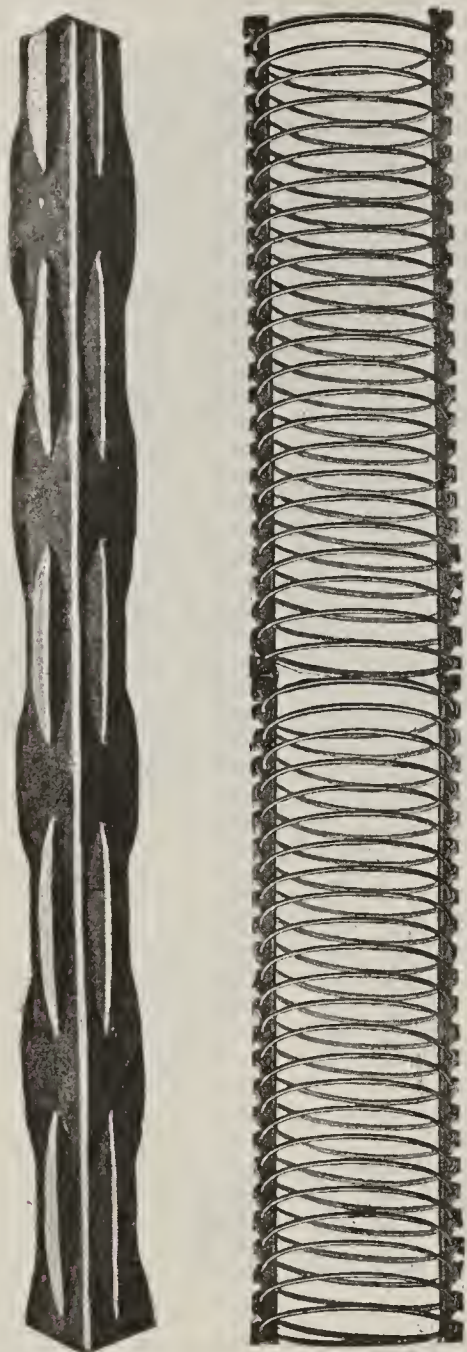
Write for prices and plans to the

American Pulverizer Co.

Cor. 18th and Austin St.

St. Louis, Mo.

We crush everything.
Why can't you do it?



STEEL BARS

AND

SPIRALS

FOR

REINFORCED
CONCRETE
CONSTRUCTION



“Bars on the Job Ready for Your Men”

Delay, caused by the failure to have your reinforcing material on the job not only throws out your calculations but also the schedule of every other contractor on the job.

You can save the loss of much time and money by specifying Havemeyer Bars for your reinforced concrete work.

Their prompt service insures your having bars on the ground when the men go to work.

HAVEMEYER BAR

Service insures direct shipments of reinforcing steel from our Chicago warehouse, which is located within easy teaming distance of the loop and makes delivery when material is needed.

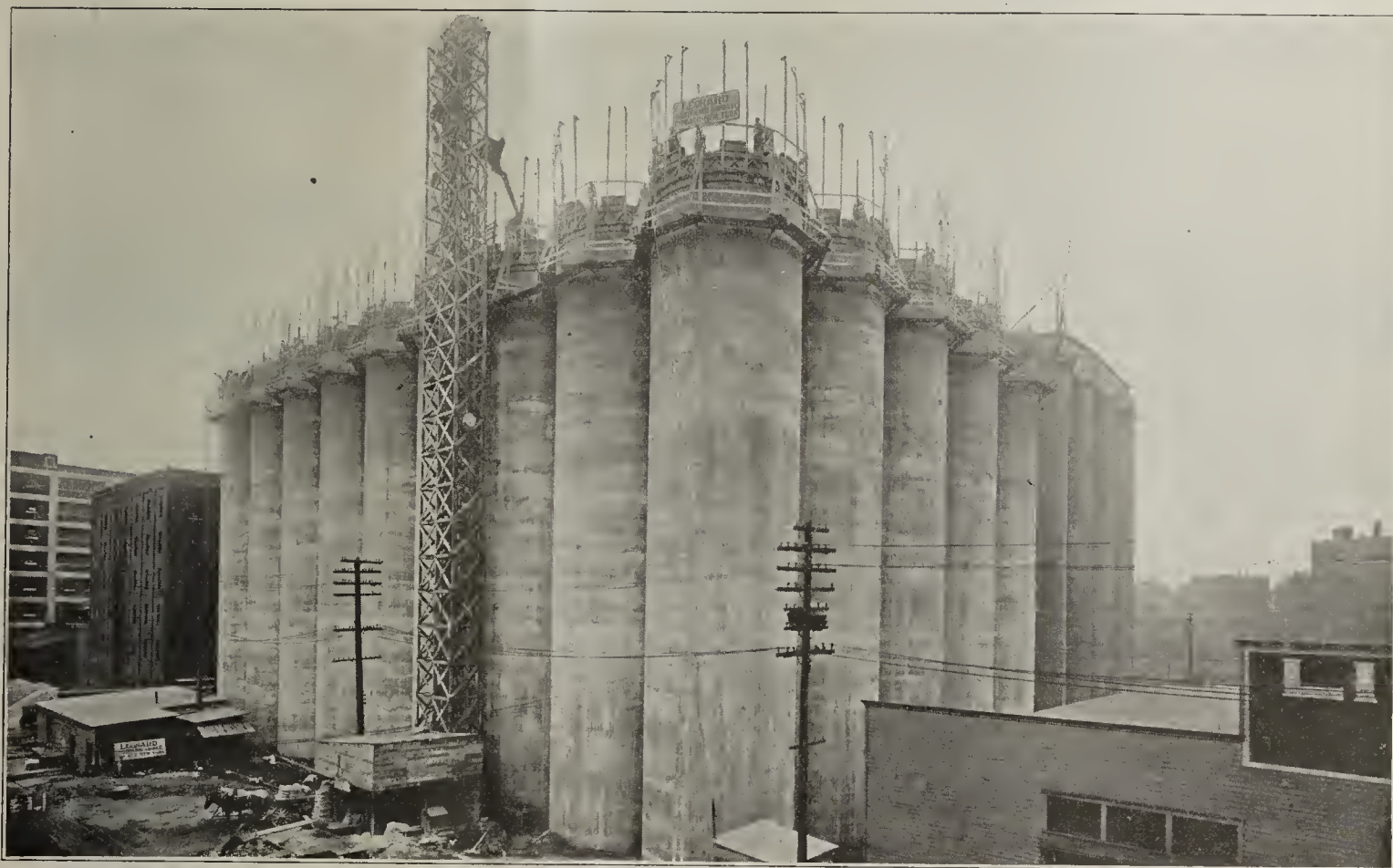
Havemeyer Products, Bar-Tys, Bar-Spacers, Ty-Chairs, Beam-Saddles, Etc., keep the steel in its right place while the concrete is being poured.

Try Our Service

CONCRETE STEEL CO.
MONADNOCK BLDG. CHICAGO

INVESTIGATION AND EXPERIENCE ARE PROVING THE RELIABILITY OF HYDRATED LIME

FOR WATER PROOFING AND TO FACILITATE POURING CONCRETE



In these 51 concrete storage tanks, recently erected in Cedar Rapids, Iowa, by the Quaker Oats Co., there are approximately 12,500 cubic yards of concrete—1-2-4 mix. The walls are perfect cylinders, with no lips or bulged surfaces.

Hydrated lime was used for waterproofing and also to facilitate pouring the concrete and lifting the forms, owing to its lubricating properties. In mixing, 25 pounds of hydrated lime was put into each batch, which made the percentage of lime to cement a little over 8% by weight. The mixers used were of such size that three bags of cement could be used in each batch.

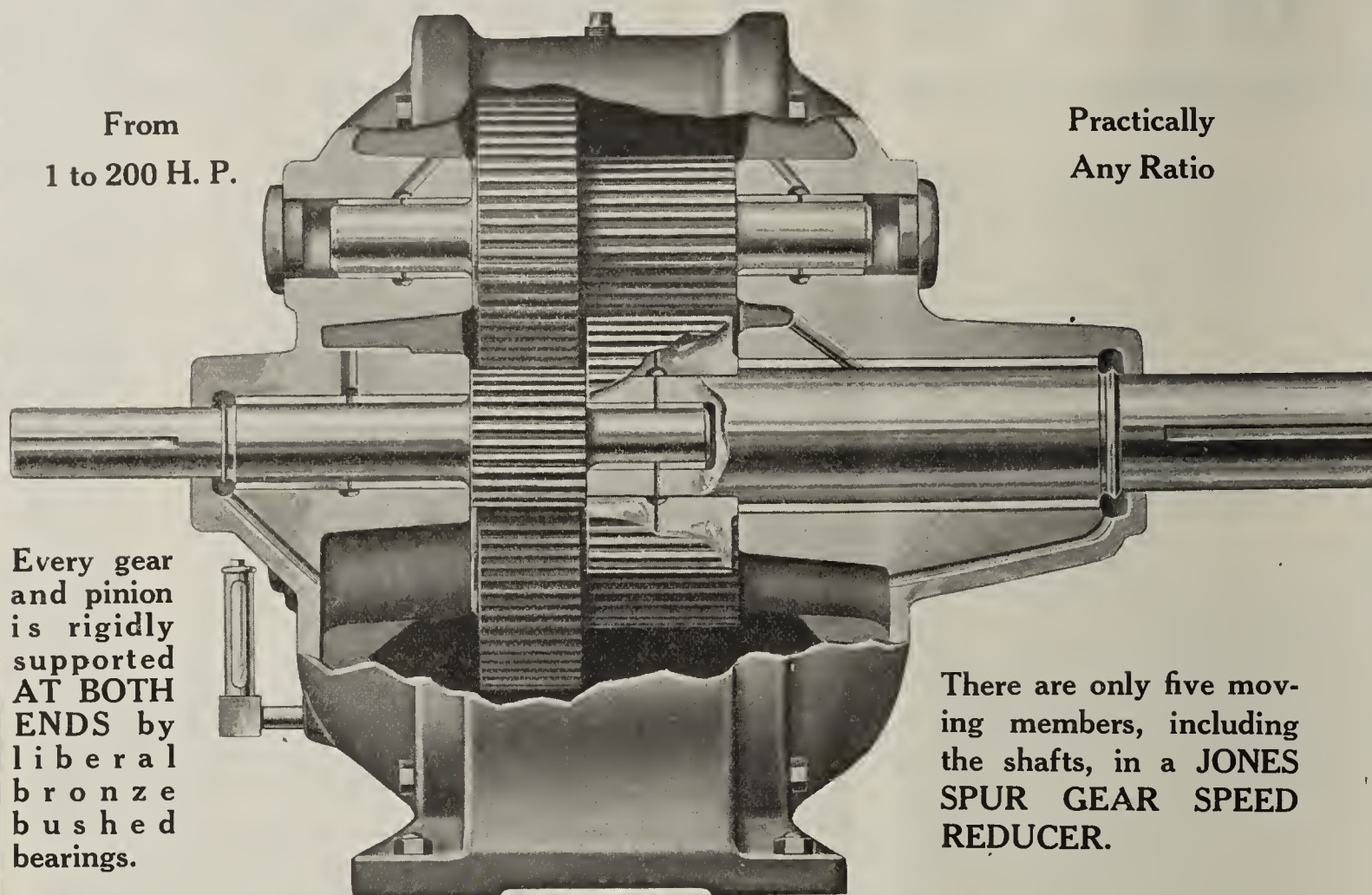
Considerable credit is given by the Leonard Construction Co. of Chicago to the lime. The statement is made that the lime gave the exterior surface a white and uniform appearance, and that the surface needed no subsequent coating. There were no joints where the concrete stuck to the forms and "lifted," as it does in many cases where the concrete is not of uniform mixture.

Write any of the following competing manufacturers of Hydrated Lime for complete information about Hydrated Lime in Concrete

- | | | | |
|---|--|--|--|
| Marblehead Lime Co.,
Chicago—Kansas City | Ste Genevieve Lime Co.,
St. Louis, Mo. | O. C. Barber Allied Industries Co.,
Canton, Ohio | John D. Owens & Son Co.,
Owens, Ohio. |
| Port Byron Lime Assn.,
Port Byron, Ill. | Palmer Lime & Cement Co.,
103 Park Ave., New York, N. Y. | Kelley Island Lime & Transport Co.,
Cleveland, Ohio | Woodville Lime Products Co.,
Toledo, Ohio |
| Lee Lime Co.,
Lee, Mass. | Rockland & Rockport Lime Co.,
New York—Rockland, Maine—Boston | National Lime & Stone Co.,
Carey, Ohio | Merion Lime & Stone Co.,
Norristown, Pa. |
| Glencoe Lime & Cement Co.,
St. Louis, Mo. | The A. & C. Lime Co.,
Canton, Ohio | Ohio Hydrate & Supply Co.,
Woodville, Ohio | Vermarco Lime Co.,
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| Hunkins-Willis Lime & Cement Co.,
St. Louis, Mo. | Riverton Lime Co.,
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COMPARE THE SIMPLICITY OF THE JONES SPUR GEAR SPEED REDUCER

With Other Speed Reducing Devices



From
1 to 200 H. P.

Practically
Any Ratio

Every gear
and pinion
is rigidly
supported
AT BOTH
ENDS by
liberal
bronze
bushed
bearings.

There are only five mov-
ing members, including
the shafts, in a JONES
SPUR GEAR SPEED
REDUCER.

All shafts are accurately ground to size.

The gears and pinions are not milled with rotary cutters, but are accurately generated, with stub teeth of 20° pressure angle (the recognized standard for automobile and truck transmissions).

The Jones Reducer is just a plain spur gear drive with no internal gears or overhung pinions involving a complicated mounting.

The consistent use of Johansson limit gages insures absolute interchangeability of parts.

Every gear pinion and bearing is flooded with oil at all times.

Sling rings on the two extended shafts keep all of the oil in the housing.

The height of oil in the housing can be determined instantly by looking at the sight gage.

Every Reducer problem is given a complete engineering analysis, thus insuring the selection of a machine amply proportioned for the full duty to be performed. Let us assist you in solving your reducing problems.

W. A. JONES FOUNDRY & MACHINE CO.

ESTABLISHED 1890

4406 WEST 12TH ST., CHICAGO, U. S. A. NEW YORK OFFICE: 30 CHURCH ST.

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COMPRESSORS

	Price
1—12x7½x10 Sullivan, 2-stage, belt drive, almost new, 300' cap.....	\$ 1,200
1—10x10x12 Laidlaw-Dunn-Gordon, steam, cap. 170' per min.....	600
1—Rand Imperial, duplex, steam, 2-stage, air, 1500' per min.....	3,000
1—8½x9 Westinghouse, almost new...	150
1—12x12x16 Ingersoll, straight line, steam driven, capacity about 300' at 80 to 100 lbs.....	600
1—Sullivan, 2-stage air, simple steam, capacity 1800' at 80 to 100 lb.....	2,500
1—14x16x10x16 Sullivan, 2-stage air, simple steam, capacity 600' at 80 to 100 lb.....	1,500
1—14x9x10 Bury, 2-stage, belt driven, capacity 350'.....	1,500
1—Ingersoll-Rand, belt-driven, 2-stage, 500'.....	2,000
1—Sullivan, 2-stage, belt-driven, 1400', good as new, f. o. b. St. Louis.....	4,500

CARS

20—4-yd. Western, 2-way, contractors, 36" gauge, wooden bodies, each...	\$ 125
70—2½-yd. steel bodied, end dump quarry cars, 36" gauge, each.....	80
30—2½-yd. steel bodied, end dump quarry cars, 48" gauge, each.....	75
20—12-yd. Western, standard gauge MCB, air dump cars, good condition, each.....	900
30—1½-yd. Koppel "V"-shaped, 24" gauge, steel cars, new, each.....	120

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1—No. 12 Style "K," manganese fitted, almost new.....	\$12,000
1—No. 9 Style "K," almost new.....	7,000
1—No. 5 Austin, angle drive, fine condition.....	1,750
1—No. 6 Style "K" Gates, fine condition, each.....	2,000
1—No. 7½ Austin, almost new.....	3,000
1—10x20 Blake jaw crusher on skids..	800
2—18x24 Blake jaw crusher, on skids..	3,000

CRANES

1—5-ton, 4-wheel Vulcan Bucyrus single line crane.....	\$ 5,000
1—22-ton O. & S. 8-wheel, M. C. B. 38-ft. boom.....	23,000

CLAM SHELL BUCKETS

	Price
1—¾-yd. Owen with teeth, almost new..	\$ 450
2—1½-yd. Hayward, first class.....	650
1—1-yd. Browning.....	500
1—1½-yd. Page Dragline.....	500
1—2-yd. Brown hoist Clam.....	800

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1—Stephens & Adamson stone screen, 42"x16", with dust jacket, practically new.....	700
1—48x18 Austin screen with dust jacket	800
1—40x18 Gates screen with dust jacket	700
1—40x18 Gates screen, with dust jacket	900
6—Stephens-Adamson screens, each....	150
1—45 Gates, 30' centers.....	500

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1—7x10 Lidgerwood DCDD, with boiler.....	\$ 1,100
1—8x12 Mundy DCDD, with boiler....	1,300
1—9x10 Lidgerwood, 3-drum, 32" drums, without boiler.....	2,000
With boiler.....	2,300
1—Clyde 9x10, 3-drum with boiler, f. o. b. Mich.....	2,500
1—8½x12 Special Dragline Swing Engine, brand new.	
1—8¾x10 Lidgerwood D. C., D. D., with boiler.....	1,750

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1—9x14 Porter 36 in. gauge saddle tank.....	\$ 1,400
1—9x14 Davenport 36 in. gauge saddle tank.....	1,400
1—19x24 Baldwin, 10-wheeler, 60 tons, just rebuilt.....	8,000
1—18x24 American 10-wheeler.....	6,000
1—17x24 6-wheel switcher.....	8,000
2—7x12 Davenport 24 in. gauge, each..	1,500

DRAGLINES

1—No. 3 Monighan 65 ft. boom, 3-yd. bucket, fine condition.....	\$12,000
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PUMPS

	Price
1—10" Morris, sand, belt drive.....	\$ 500
1—8" Morris, water, belt drive.....	300
1—20x10x14. Worthington duplex.....	600
1—Wilson-Snyder water works pump, complete with condenser.....	2,000

STEAM SHOVELS

1—28 Marion traction, ¾-yd. dipper...\$	4,600
1—No. 1 Thew traction, 1¼-yd., perfect condition.....	5,500
1—No. 0 Thew traction with ¾-yd. dipper, fine condition.....	4,000
1—No. 1 Vulcan revolving shovel, standard gauge with ¾-yd. dipper, good as new.....	4,500
Same as above, with 35' crane boom.....	5,500
1—45-ton Bucyrus, standard gauge, 1¾-yd. dipper.....	6,500
1—Model 60 Marion with 2½-yd. dipper	7,000
1—70-ton Bucyrus with 2½-yd. dipper.	6,250

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1—9x10 Lidgerwood, 3-drum engine and boiler and carriage and part of other fittings, no rope.....	\$ 3,000
1—7x10 Flory steam DCDD with boiler, carriage and all fittings but no rope.....	1,950

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2—80 hp. Erie Economic, each.....	\$ 1,000
1—25 hp. vertical American hoist and derrick.....	800
1—40 hp. firebox on steel truck.....	550
1—50 hp. vertical butt strap.....	750
1—60 hp. vertical Lidgerwood.....	800
2—250 hp. Marine type, 150 lb., each..	3,500

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1—20 hp. Westinghouse, 60 cycle, 3 phase, 220 volt.....	\$ 400
1—30 hp. Westinghouse, 60 cycle, 3 phase, 2,200 volt.....	500

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Successors to
GEO. C. MARSH & Co.

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750 Old Colony Bldg., Chicago

STEAM SHOVEL

Marion Model No. 20 with 1 1-4 yard dipper as good as new. Can make immediate shipment.

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LOCOMOTIVE CRANES STEAM SHOVELS LOCOMOTIVES CARS RAILS HOISTING ENGINES GRAB BUCKETS STONE CRUSHERS COMPRESSORS ETC.

Try us for honest value in dependable "used" material of this character. We'll treat you right.

Wm. B. Grimshaw Co.
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Dealers in "Used" but "Not Abused" Machinery

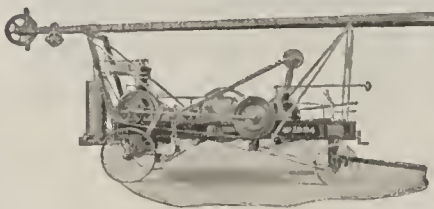
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10—60,000 cap. steel underframe flat cars.
2—8,000-gal. tank cars.
9—1-ton Hunt's back latch buckets.
Erie B revol. tract. steam shovel.
Thew No. 0 revol. tract. gas shovel.
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A. V. Konsberg

226 S. La Salle St., Chicago.

A Big Blast-Hole Drill That's Reliable



The Cyclone No. 14

Heavy, solidly braced frame—Sill timbers 4" x 14". All machinery placed directly on the main sills protecting it against strains and preventing top heaviness. **Eighty per cent (80%) of the castings are cast steel—not cast iron.** The Cyclone No. 14 is the only Blast-Hole drill so built. Furnished in Steam, Gasoline, Compressed Air or Electric Power; traction or non-traction.

The Sanderson Cyclone Drill Co., Orrville, Ohio
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BALLS

Forged steel balls of special analysis steel from 2" to 15" in diam. carried in stock. Can't be excelled.

BALL MILL PLATES	GRIFFIN MILL CROSSHEADS
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GRIFFIN MILL SHAFTS	for High Pressure Work
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Hammer and Hydraulic Press Forgings of all kinds

We make quick service a feature of our business

TIOGA STEEL & IRON CO.

52nd AND GRAY'S AVENUE, PHILADELPHIA, PA.



Winter

Doesn't Stop the Burial Vault Business

There is a constant demand the year round. A demand that you can supply with just one set of our Steel Molds. Think how nice it would be to have a neat little income during the winter months and all the year round.

The AUTOMATIC SEALING VAULT

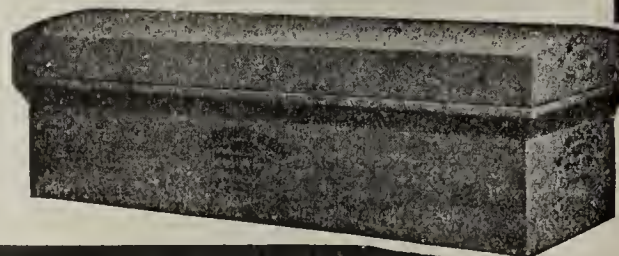
pay big profits from fifteen to 24 dollars on each one. You can develop this as a side line or devote all your time to it. Make the dollars come in this winter

by making the AUTOMATIC SEALING VAULT
The First Step is to send for information. We'll furnish full details and particulars. Write Today.

The Automatic Sealing Vault Co.

216 East River Street - - - Peru, Ind.

The Finished Vault



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For immediate Delivery—Overhauled and Guaranteed—Largest Stock in America to Choose From. For Sale: 3 Phase, 60 Cycle, 220 V.

H.P.	Speed
1—3 —General Electric...	1800
1—3 —Westinghouse	1200
1—5 —Wagner	1800
1—5 —Allis Chalmers.....	1200
1—7½—General Electric...	1800
1—10 —Westinghouse	900
2—15 —Westinghouse, Type CCL	1750
2—15 —Watson, slip-ring, var. speed.....	1720
1—15 —Fairbanks-Morse ...	1200
1—15 —General Electric, Form L.....	1200
1—15 —General Electric...	1200
3—15 —Fairbanks-Morse, slip-ring, constant speed	1200
1—15 —Westinghouse, vertical	1135
2—15 —Allis-Chalmers	1130
2—15 —Allis-Chalmers	860
2—15 —Westinghouse	850
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Send for MONTHLY BARGAIN SHEET Showing Complete Stock and Net Prices.

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16TH AND LINCOLN ST
CHICAGO, ILLINOIS

Capital and Surplus, \$500,000.00

For Sale

BUCYRUS SHOVEL

Standard, Electric, 60-ton, with 2½ cubic yard dipper; capacity 250 cubic yards per hour, fully equipped with electric motors and automatic control throughout; operates with 2,200 volt or 440 volt; 3 phase, 60 cycle current; mounted on standard 8-wheel M.C.B. trucks. PRICE \$25,000 f. o. b. cars in California. All in first-class working order, ready for immediate delivery.

Also, one

INSLEY DRAGLINE EXCAVATOR

with 2 one-half yard buckets operating, one going up, one down, over a fabricated steel framework of sufficient height for loading into cars or trucks, together with 56 h.p. distillate motor, double drum hoist, etc., original cost about \$5,000. PRICE \$3,000 f. o. b. cars in California.

Also, one

WESTINGHOUSE 30 H.P. MOTOR

60 cycles; 3 phase; 2,200 volts; 850 R.P.M. with auto starter. In fine condition.

WILLIAM H. FORD

704 Market St.
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Rock Drills

6 35/8" Murphy, nearly new
1 3 1/2" Murphy, nearly new
1 3 1/4" Murphy, nearly new
2 3" Murphy, nearly new
23 Victor Jackhammer Drills, new

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2,000 cu. ft. Rand and 50 others

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A highly competent and efficient chemist with ten years' experience as chief chemist and superintendent wishes to communicate with a company having such a position open. Address C. D., c/o Cement and Engineering News, 672 Transportation Bldg., Chicago.

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Mechanical Engineer of sixteen years' experience in the construction and operation of cement plants, wishes to change from his present location. Thoroughly capable of designing, building and operating cement mills of any capacity. Particulars furnished on request. Address Box 12, care Cement & Engineering News, Chicago, Ill.

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Superintendent for Cement Plant. Located in Lehigh Valley; 2,000 bbls. daily capacity. Must be available Jan. 1st or before. Write fully, giving experience, references, age and salary expected. Address C-C-H, c/o Cement & Engineering News, 672 Transportation Bldg., Chicago, Illinois.

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Young married man. Twelve years' experience. College education. Full charge of laboratory in 4,000-barrel mill. Desire better living conditions. Best references. Box 27 c/o Cement & Engineering News.

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CONVEYOR BELTS A SPECIALTY

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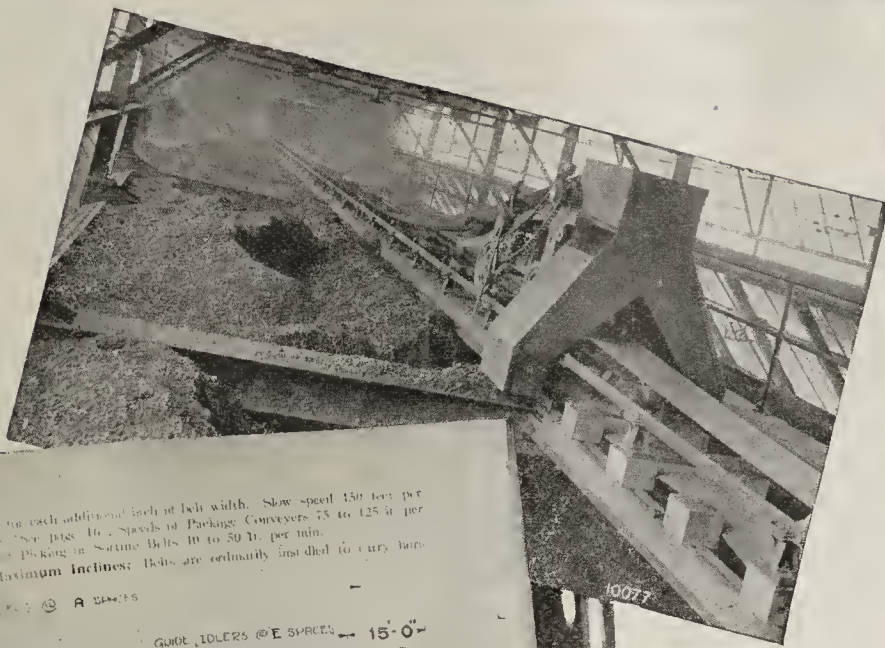
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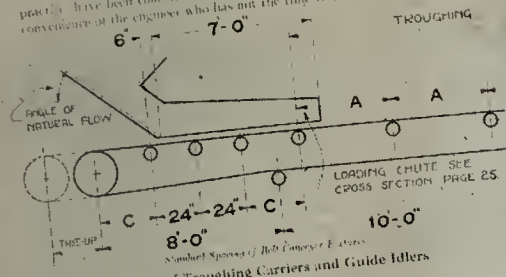
SERVICE

Every Page of Our New Belt Conveyor Catalog Has Valuable Information for Engineers



A Handy Guide for the Busy Engineer

The following general rules, which embody the best in Belt Conveyor practice, have been collected out of the various pages of this book, for the convenience of the engineer who has not the time to go further into details.



Spacing of Troughing Carriers and Guide Idlers

Width of Belt (inches)	Number of Carriers (per 100 ft.)	Spacing of Carriers (ft.)	Number of Guide Idlers (per 100 ft.)	Spacing of Guide Idlers (ft.)
14-16	3-4	1-6	1-2	3-4
18-20	4-5	1-6	2-3	3-4
24-30	5-6	1-6	3-4	3-4
36-42	6-7	1-6	4-5	3-4
48	7-8	1-6	5-6	3-4

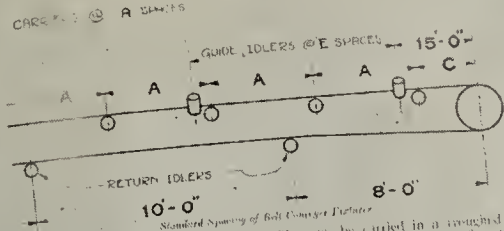
WIDTH OF BELTS: For loose materials use at least 4 times the largest size of material handled plus 6 inches or 4 times the average sized pieces plus 6 inches where such pieces are about 70% to 80% of the whole, with the width of the belt in no case to be less than twice the largest pieces to be handled plus 8 inches, where such pieces do not exceed 10% in uniform distribution of all the material carried.

Capacity in Tons Per Hour of materials weighing 80 pounds per cubic foot and carried over three or five pulley troughing carriers is approximately 8% of the square of the number of inches in the width of the belt, for each 100 feet of belt speed per minute.

Maximum Speeds of Belts for loose materials equal approximately an initial speed of 250 feet per minute for a ten inch belt, plus 10 feet per (Continued on page 11)

minimum for each additional inch of belt width. Slow speed 150 feet per minute. See page 16. Speeds of Package Conveyers 75 to 125 ft. per min. Packing on Slatting Belts 10 to 50 ft. per min.

Maximum Inclines: Belts are ordinarily installed to carry horizontal.



zimuthally, although most materials readily may be carried in a troughed belt at 15° to 20° to the horizontal, many others as high as 21°, 24°, and some even at 25°. Recommendations covering angles over 10° will be made upon statement of material to be handled, incline in service, and nature of installation. See page 21.

Horse Power Required: Approximately 2% of the number of tons per hour carried for each 100 feet of horizontal belt length and 1% additional for each 10 feet rise of incline. Increase this Horse Power of the belt 5% for each driving reduction thru chain, belting or cut gears, and 10% for each reduction thru rough gears to obtain the final Horse Power at Line Shaft, Motor or Engine. See page 13.

Belt Values: Proper Flexibility in Belts for Troughing Carriers is one ply per inch 4 to 5 inches of belt width with 12 inch, 3 ply as a minimum and 48 inch, 8 ply as a maximum in ordinary service. See page 18.

Ultimate Strength of the average Rubber Belt is 360 pounds per inch width of each ply, with a safe working tension of 30 pounds per inch width of each ply. Factor of safety 12. See pages 12 and 13.

The pull required to move a belt over its carriers upon the level is approximately 20% of weight of belt plus 10% of weight of load upon the belt.

Terminal Pulleys: The diameter of drive pulleys in ordinary good practice is 5 times the number of belt plies with the diameter of all other pulleys taking 180 degrees wrap 4 times the number of plies. See page 22.

Cleaning Brushes: Cleaning brush speeds are ordinarily 800 to 1600 feet per minute at the surface for dry dusty materials; 1000 to 1200 for damp materials; 1200 to 1500 for wet, sticky materials.

Take Pages 10 and 11 as illustrated above. Here are 9 general rules embodying the best in Belt Conveyor practice, which have been collected out of the various pages of this book, for the convenience of the busy engineer who has not the time to go further into details.

The picture at the top of page illustrates the efficient manner in which Jeffrey Belts and Trippers automatically and uniformly fill large bins or storage space. They are practically noiseless in operation, require practically no attendant labor, occupy small space and require little power to operate.

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Handle it Mechanically

CEMENT AND ENGINEERING NEWS

with which Gravel & Stone Magazine is incorporated

(PUBLISHED MONTHLY)

William Seafert, *Publisher and Editor*

J. F. Waldron, *Advertising Manager*

R. M. McCully, *Business Manager*

Office—672 Transportation Building, Chicago

Telephone, Harrison 5397

Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, \$1.00 per year; all
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Single Copies 20c.

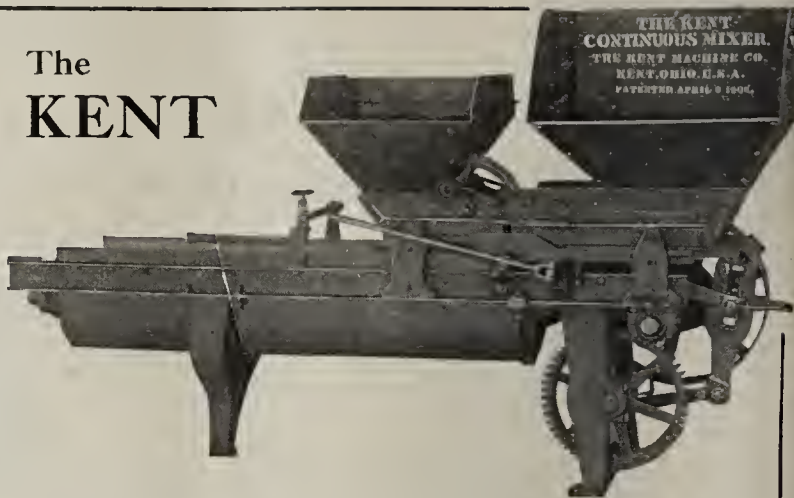
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GINEERING NEWS will be sent until we are notified to discontinue—Such
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Vol. 31 CHICAGO, APRIL, 1919 No 4

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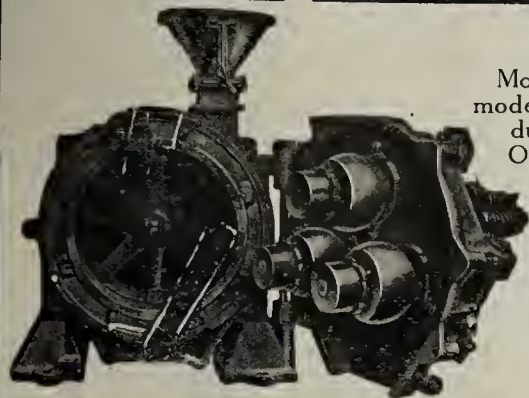
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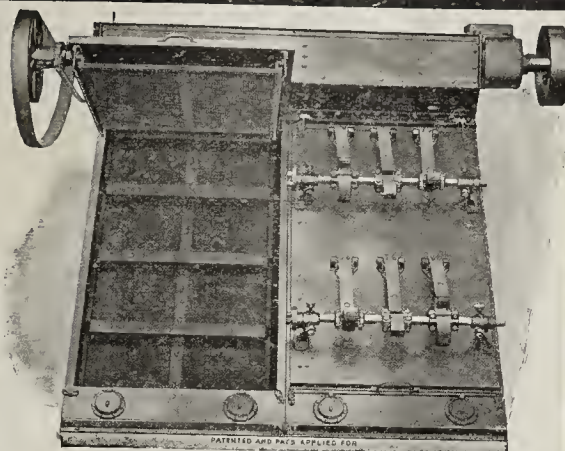
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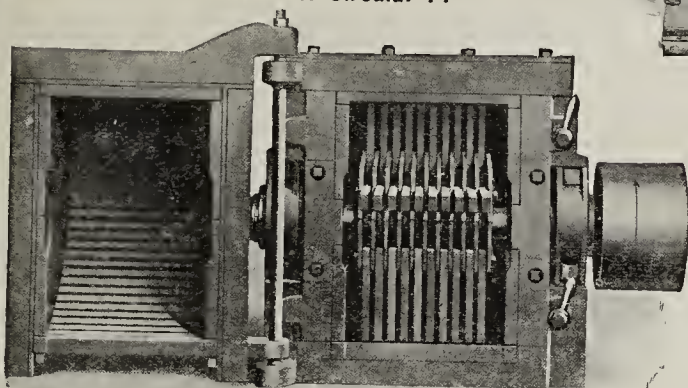


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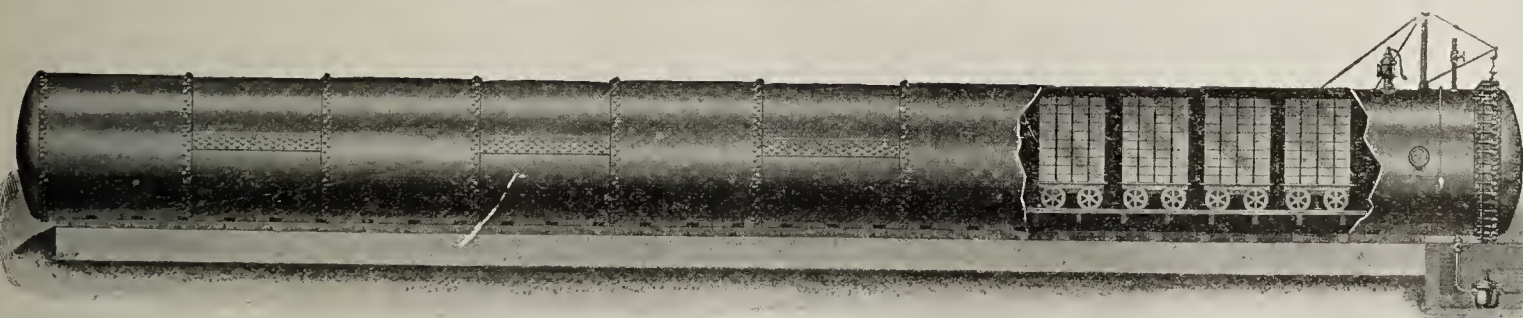
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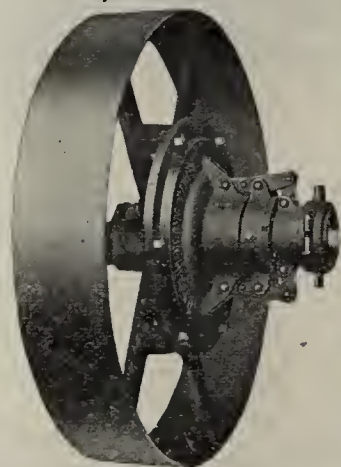
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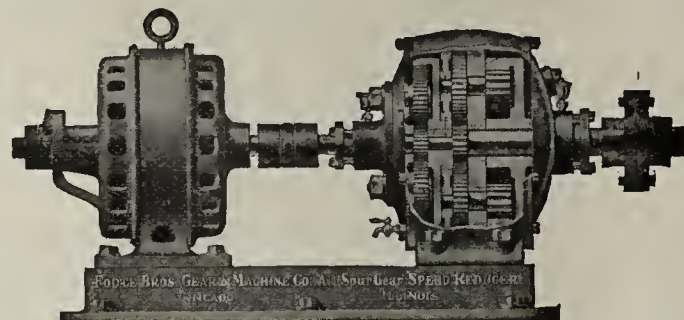
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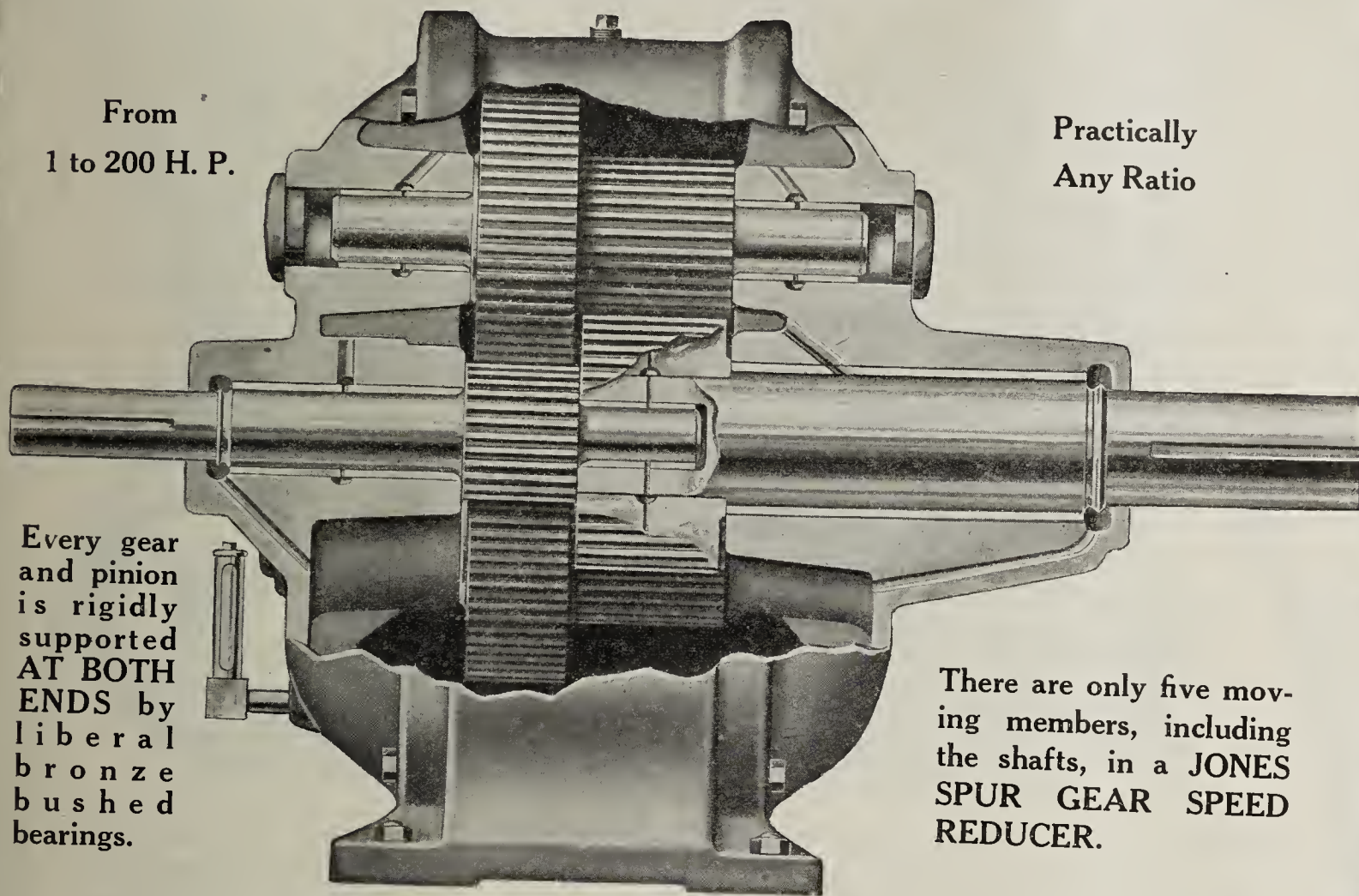
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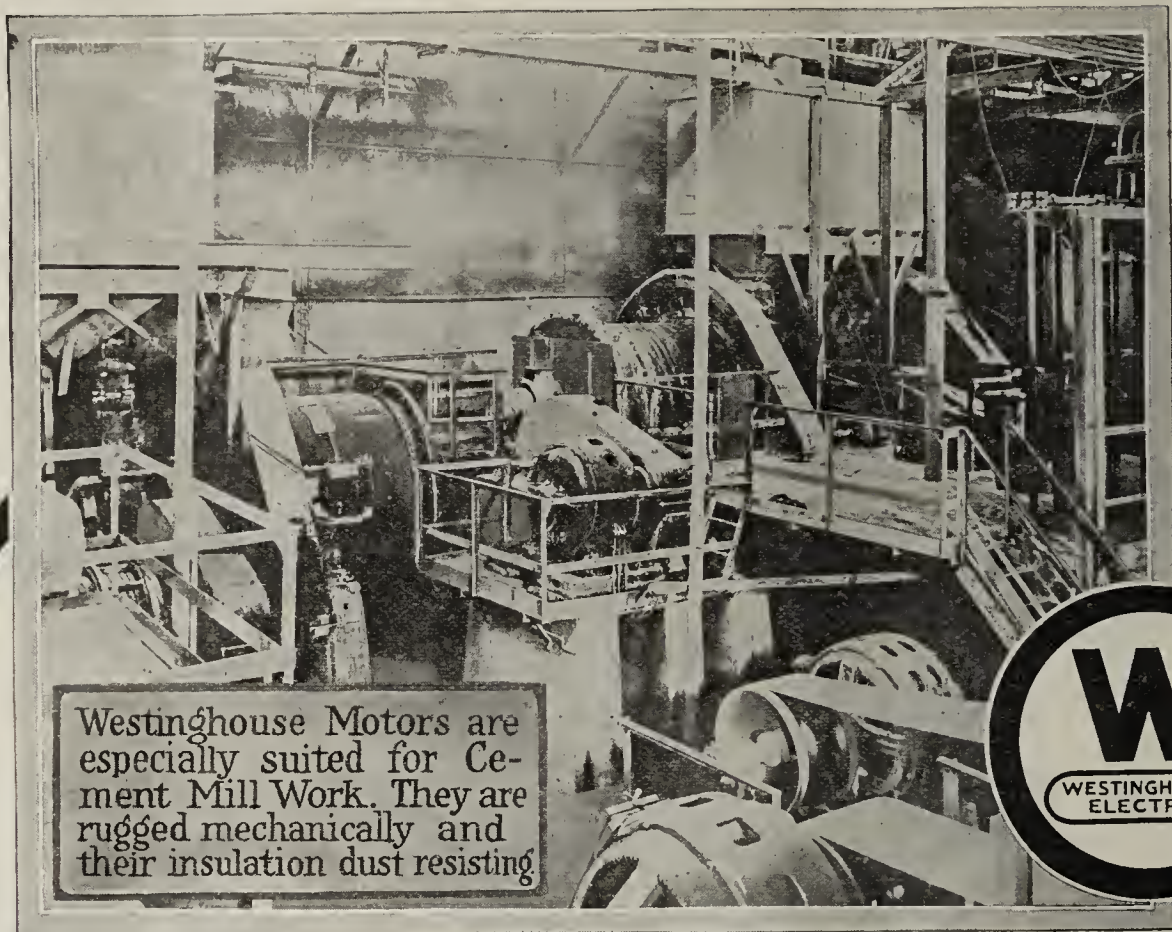
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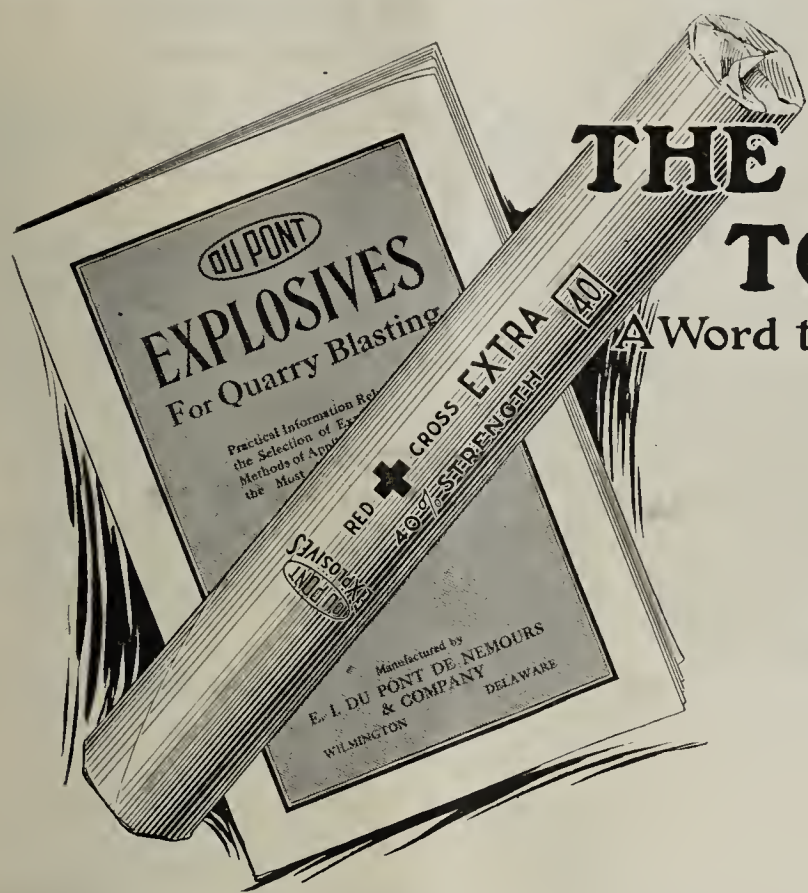
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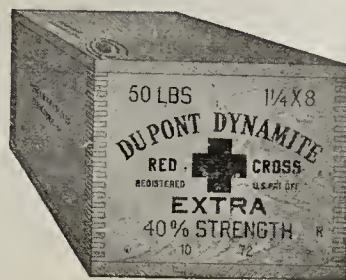
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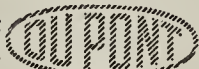
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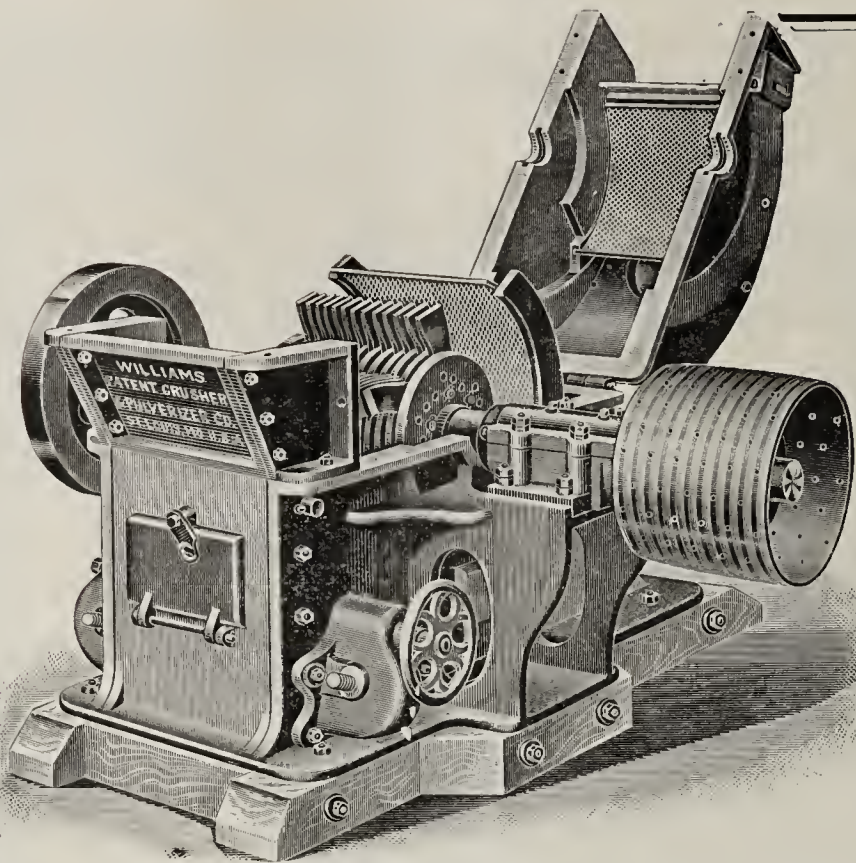
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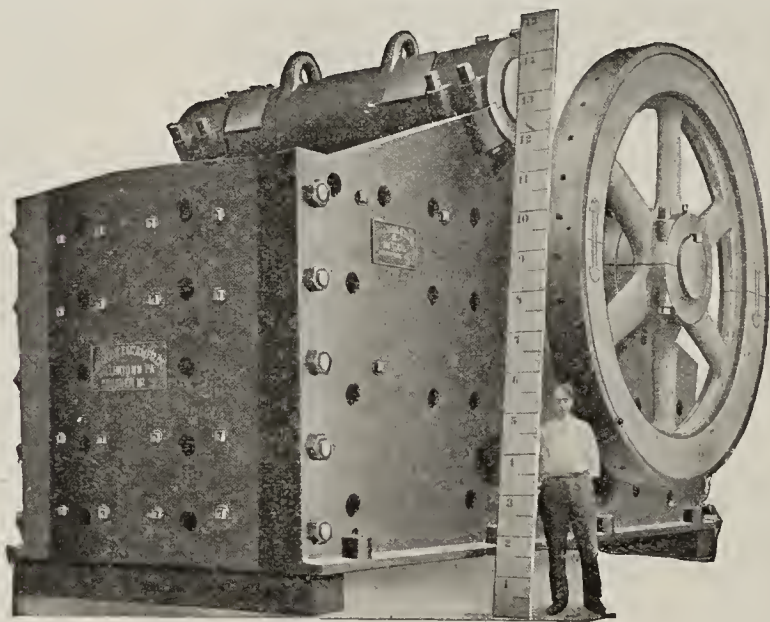
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All Traylor Jaw Crushers have cast steel water cooler pitmans.

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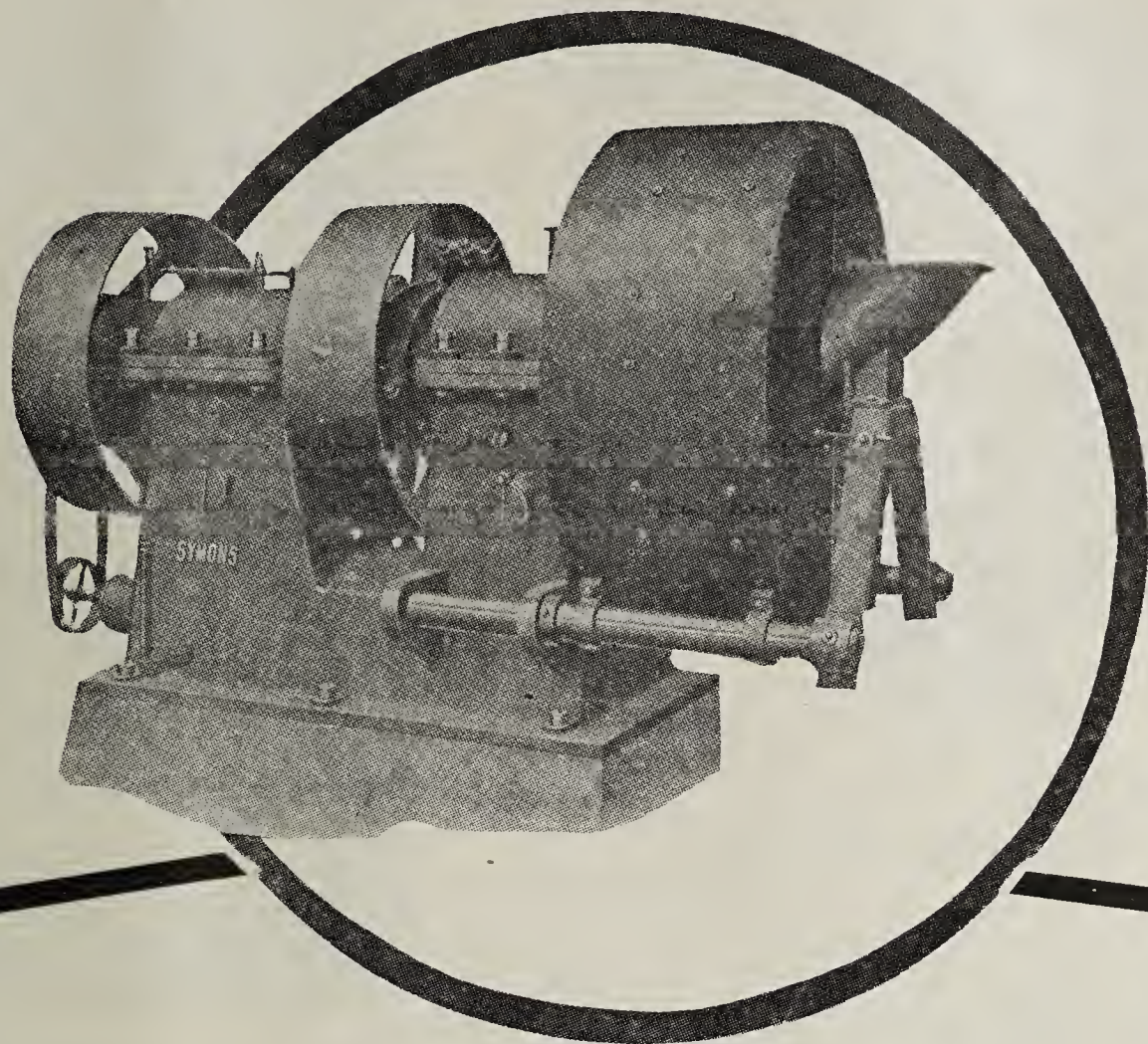
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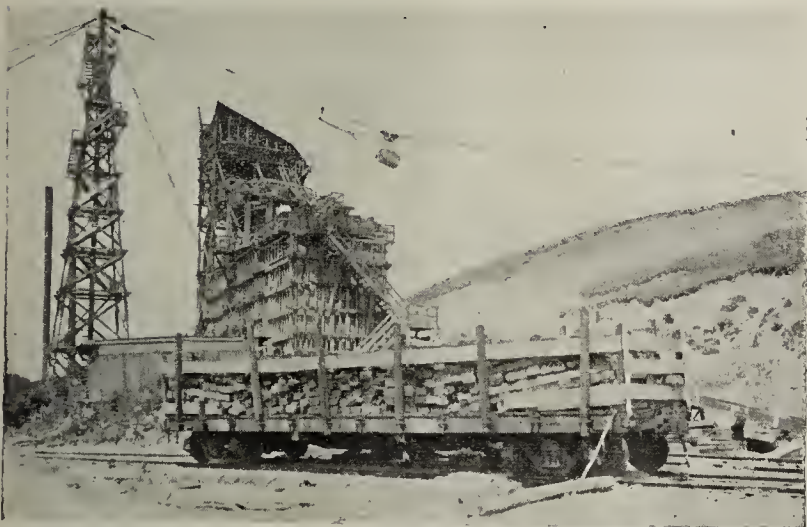
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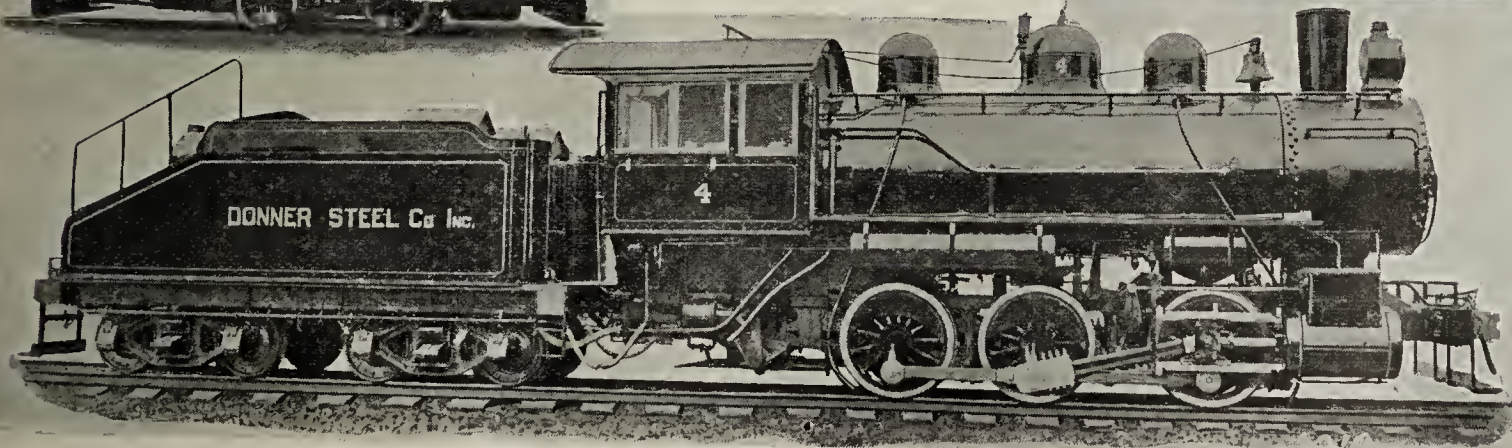
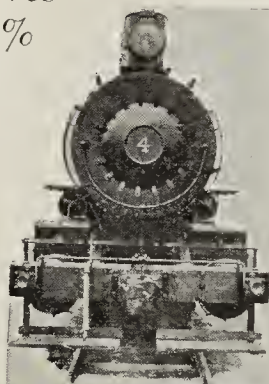
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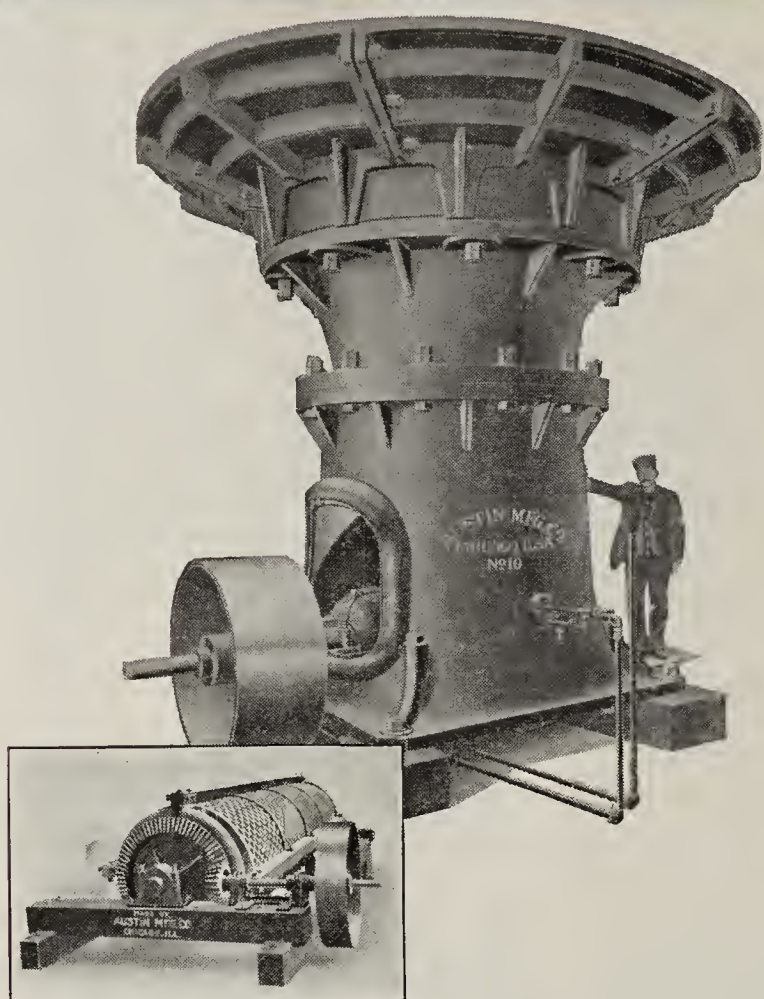
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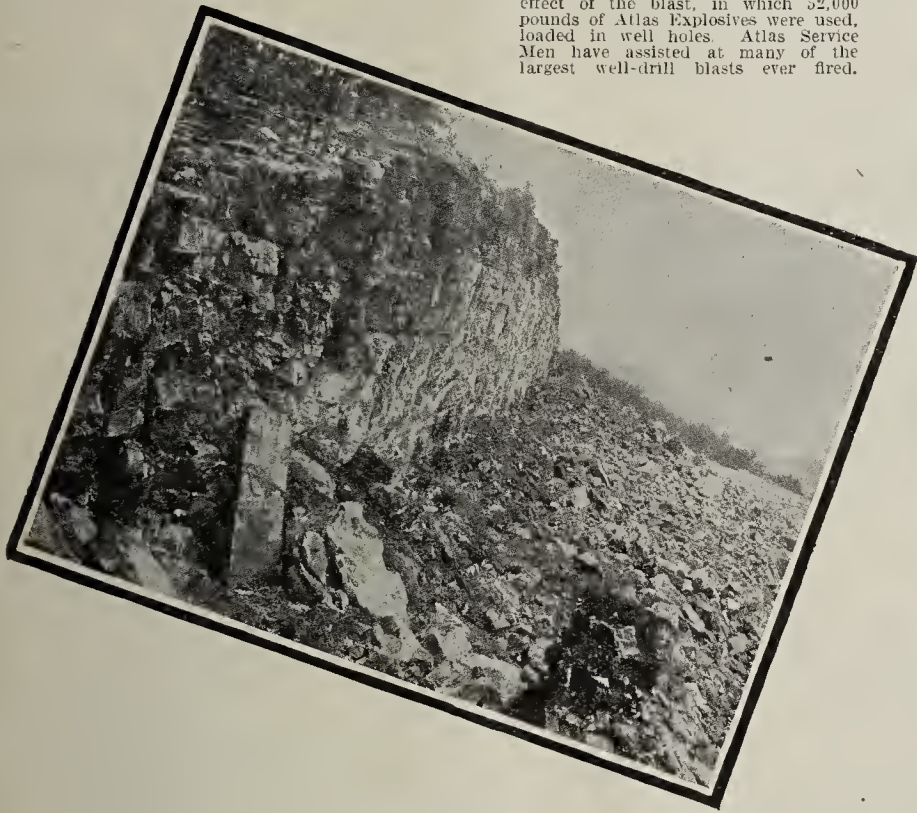
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Atlas Explosives



Above: Face in quarry of Dixie Portland Cement Company, Richard City, Tenn., before the blast. Below: The effect of the blast, in which 52,000 pounds of Atlas Explosives were used, loaded in well holes. Atlas Service Men have assisted at many of the largest well-drill blasts ever fired.



have reduced *blasting* costs and—by breaking the rock right—have reduced *handling* costs in every class of quarry work.

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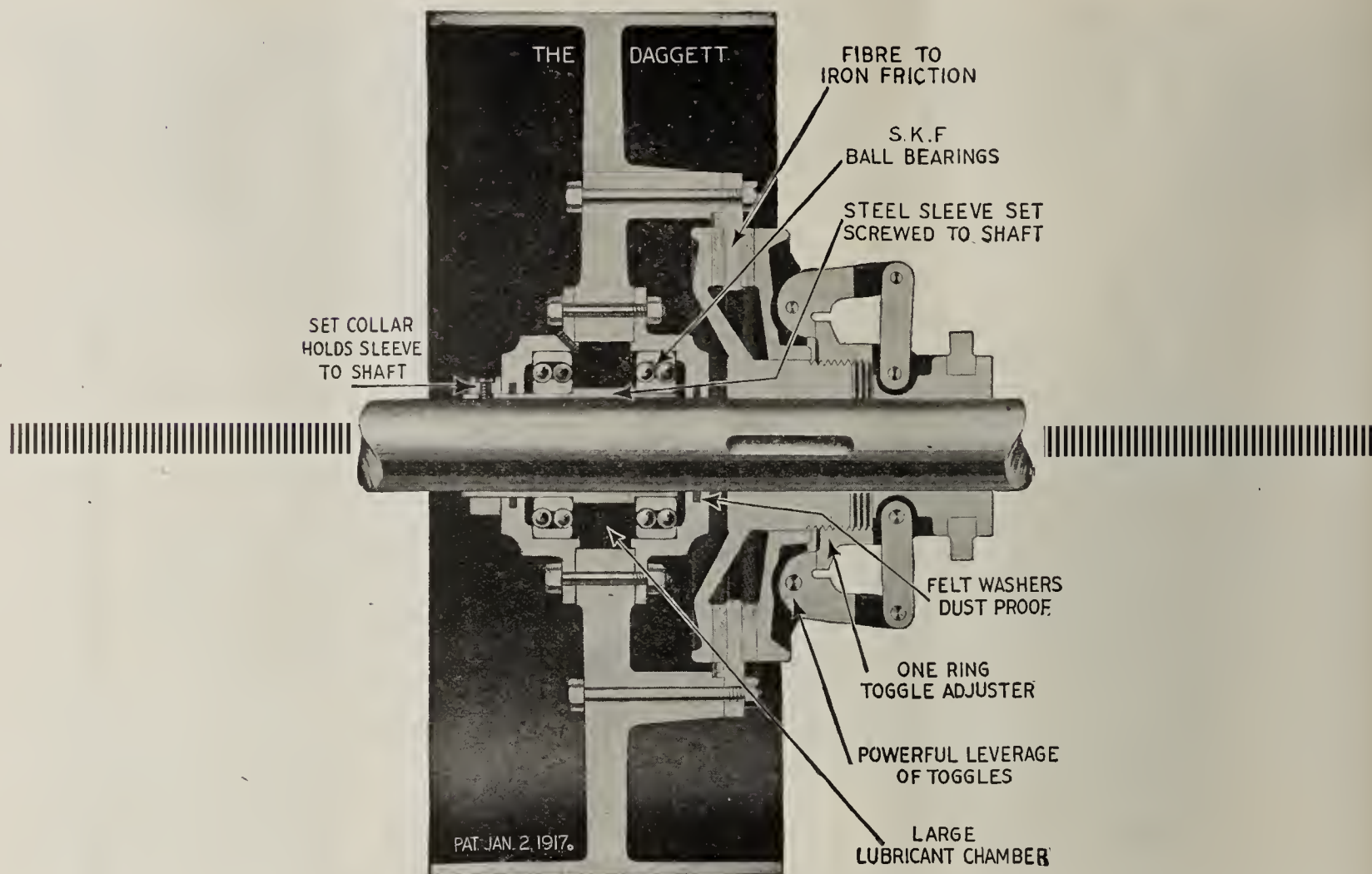
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(illustrated above) is the finest mechanism of its type on the market. Shipped on short notice.

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We also keep in stock a complete line of Oneida Steel Pulleys and can make immediate delivery.

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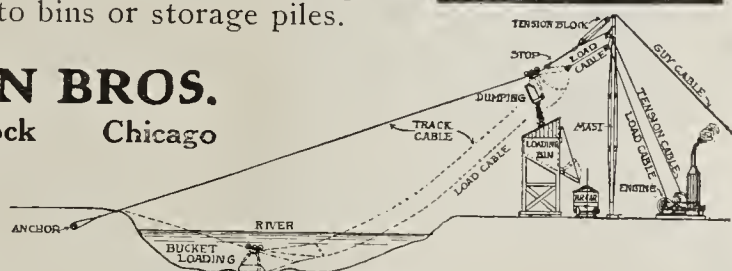
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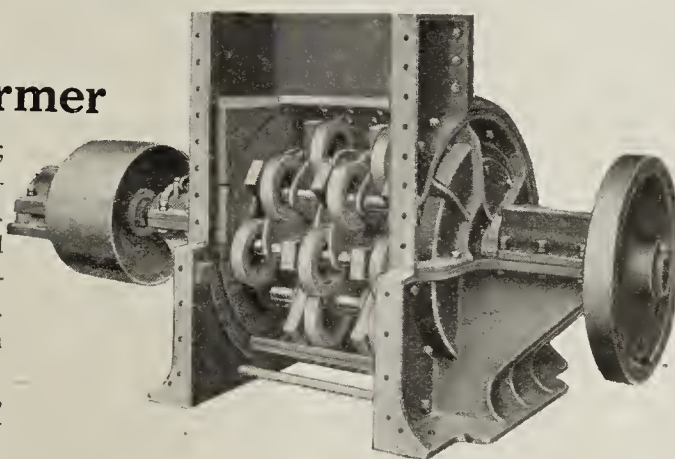


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are earning enormous profits for their users. The plant here shown paid five times its cost in profits in five months running. This is not an isolated instance. Many others have done equally well or better in producing

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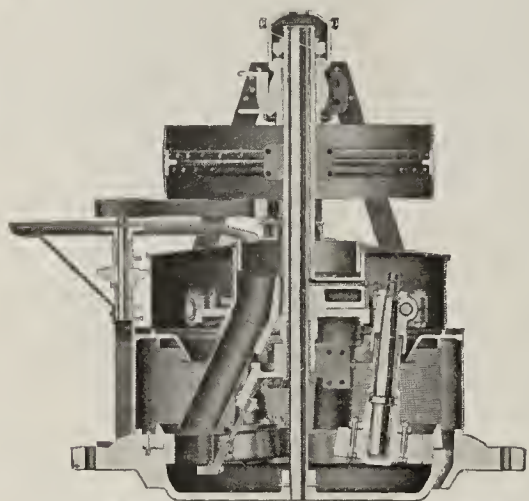
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Twenty-two mills sold without advertising—a record unequaled in the cement industry.

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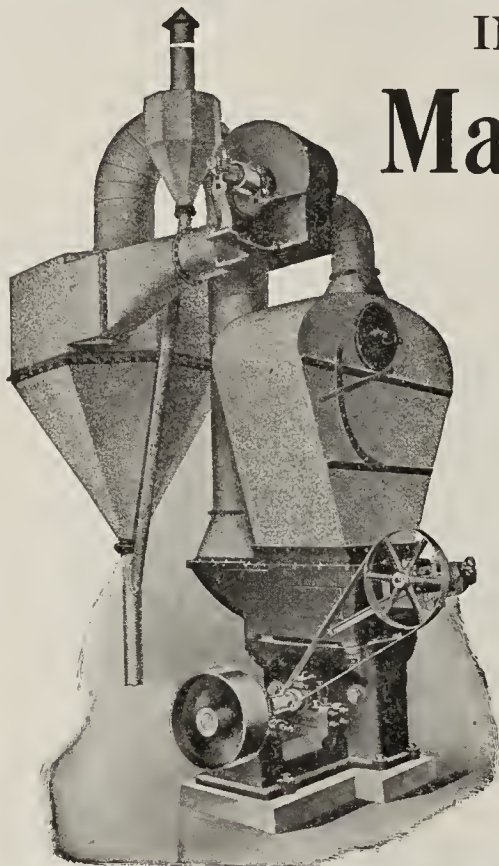
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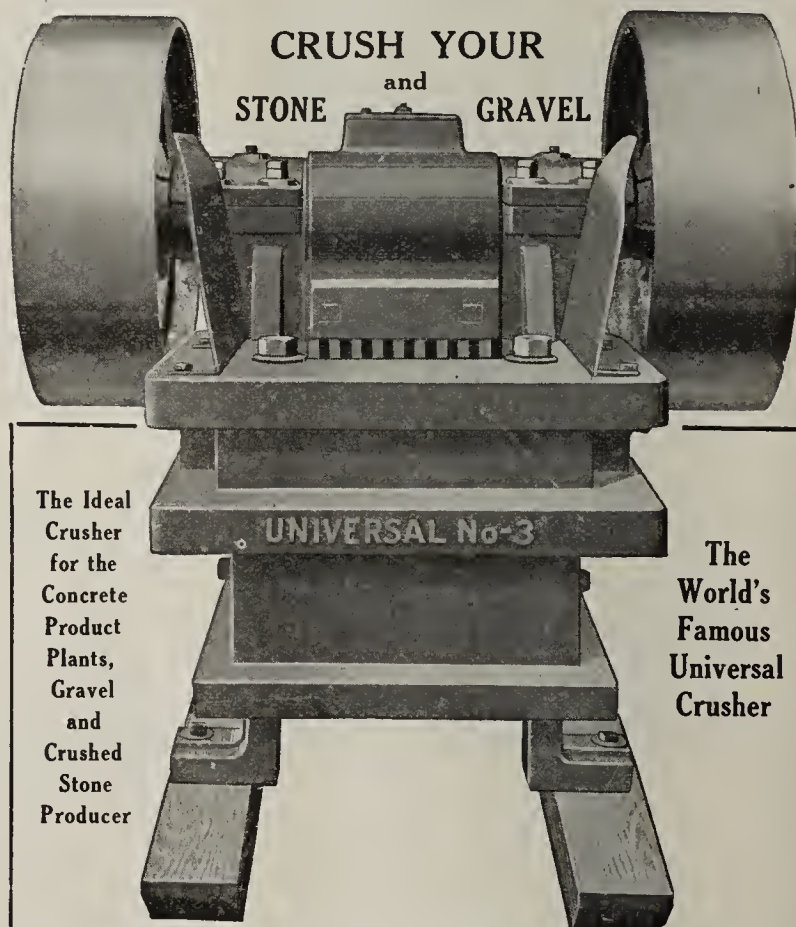
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UNIVERSAL CRUSHER COMPANY
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Editorial

What America Could Do if it Tried

During this war the United States has had a remarkable economic experience. It is to be hoped that the eyes of the nation and the masters thereof are open enough to see it and understand it.

We have spent untold treasure, and we have more treasure than we had when the war began.

We have sent some 2,000,000 of our choicest workmen into military cantonments and over to France, we have subtracted these from the ranks of constructive labor, and set them to the task of destruction, yet our factories are as prolific as they ever were.

The best hands have been taken away from the farm, yet our crops are bigger.

We have plunged into the extravagance of war, yet we have discovered 20,000,000 bondholders, and more people are saving money and investing it today than ever before.

Mines have been robbed of their laborers, yet the output has increased and not decreased.

Although the nation has been subjected to the most terrible strain in its history it has shown greater industrial strength and efficiency than ever before.

Our losses have run into the billions, yet profits are greater and wages are higher.

The fact is that war has been a whiplash that has made America realize its strength.

If we could only put into the everyday life of constructive business the energy, the enthusiasm and the splendid unity we have put into the war, what could we not do?

Mark Twain tells of a Mississippi river pilot who navigated his boat one dark night through the most perilous channels. His skill was uncanny. The other men on the boat watched him with breathless amazement. And after the danger was passed and the pilot was relieved they discovered that he had been doing it all in his sleep. And they said:

"What couldn't he have done if he was dead!"

States May Have Millions of Federal Government Money for Roads

Business and Labor Conditions Improved by Construction Work.

Road-building authorities are predicting that 1919, 1920, and 1921 will prove the greatest in the country's history in the matter of road construction. In view of the unprecedented appropriations of funds for Federal aid for road projects and the activities of the States in extending their road-building programs the prediction appears to be fully justified.

The Division of Public Works and Construction Developments of the United States Department of Labor is authority for the statement that there has been a revision and enlargement of road-building plans in almost every state in the Union since the signing of the armistice. This is due not only to the pressing need for road construction, which has been suspended dur-

ing the war, except where construction was essential to military activities, but also to the obvious desirability and prudence of getting public works under way so there may be such a demand for labor as will absorb the labor surplus.

Ultimately there will be a labor shortage in the United States. At present there is a surplus, and this is apt to grow to embarrassing proportions during the next few months of demobilization if no conscious effort is made to immediately revive building and construction activities to provide buffer employment until our industrial readjustment has been completed. Quite as important is the effect of an immediate acceleration of construction work on general business conditions. Federal, state and municipal construction projects, assisted by private and corporation building activities, will be potent stimuli for general business and will prevent the stagnation which would spell commercial disaster.

Federal aid for road construction for 1919, 1920, and 1921, has been provided on a more liberal scale than ever before. If millions of federal funds are not absorbed by the states in state road projects, it will be no fault of the federal government. Millions are available. How completely the possibilities of the present opportunity are approximated depends on the state administrations.

Federal funds to the amount of \$266,750,000 will have been made available for state road projects by the end of the fiscal year of 1921. Under legislation enacted prior to the last congress there are available for 1917, 1918, and 1919—and now apportioned among the states—\$29,100,000. To this, the last congress added \$48,500,000 for the fiscal year 1919, making the total of federal aid for road construction to the end of the fiscal year 1919, \$77,600,000. In 1920 there will be \$92,150,000 available for this work, and in 1921 an additional \$97,000,000.

The last congress amended the federal-aid law in such fashion as to give the states more latitude in building. These changes became a law through the passage of the Post Office appropriation bill, sections 5 and 6. The Division of Public Works and Construction Developments of the Department of Labor has reason to believe and recent conference of governors and mayors in Washington resulted in a more thorough understanding of the necessity for and prudence of liberal road-building policies throughout the country. The latest information compiled by the division showed 18 states endeavoring to increase their appropriations for road building. The states and the amounts involved in the plans pending at the time the information was furnished (late February) are as follows:

Arkansas, \$5,000,000; Colorado, \$20,000,000; Georgia, \$40,000,000; Illinois, \$60,000,000; Kansas, \$60,000,000; Michigan, \$50,000,000; Minnesota, \$100,000,000; Missouri, \$60,000,000; Montana, \$15,000,000; North Carolina, \$25,000,000, available at the rate of \$2,500,000 per year; Oklahoma, \$50,000,000; Pennsylvania, \$50,000,000; South Carolina, \$25,000,000; South Dakota,

legislation pending to extend the road program but no estimate of the amount to be spent; Tennessee, \$40,000,000; Texas, \$75,000,000; Washington, \$30,000,000, available over a period of six years; and West Virginia, \$50,000,000.

Most of the foregoing was on March 1 dependent on state legislation or on referendums on bond issues, and, if, in every instance, the propositions were carried as planned, only a lesser portion of the money would be available this year, and, in some states, none would be available until after November of 1920. The figures indicate, however, that the states are taking a new interest in the road-building movement and further justify the prediction that the next three years are to bring unprecedented activities in the improvement and extension of America's road system.

It is admitted in the Department of Labor that present construction costs are much higher than the pre-war level. In part this is accounted for by freight rates on road materials established during the war to prevent the movement of these materials for work other than government work. There is every reason to believe these rates will be revised at once. The effect of such revision will be favorable to reduced construction costs, but most authorities are agreed that pre-war prices in this field will not be reestablished. The condition of our currency and the generally higher price levels throughout the world, so these authorities assert, will not permit a return to prewar prices, and for these reasons present construction prices are not as abnormal as the popular mind is prone to believe them.

The Division of Public Works and Construction Developments of the Department of Labor asserts, regardless of present construction prices, it is a paying investment for states to at once get road work and construction of public improvements under way. The dividend and benefit of this policy will appear in the early improvement of general business conditions and the ready absorption of such labor as is released from the army and war industry.

Farm Improvement and Rural Construction Work will Aid in Readjustment

Farm products have a greater purchasing power today than ever before in the country's history. This may explain why rural districts of the country rapidly are getting under way with building and construction work. It is obvious, since building and construction work have such an important bearing at this time on stimulating general business, the farmer may serve both his own and the national interest by at once making needed improvements on his property. He can further the general welfare while assuring himself of immediate and permanent benefits, in urging road construction and improvements in his locality.

It is generally understood no material reduction may be expected in building and construction costs in the near future. To be sure, prices on some materials may be slightly reduced in the readjustment, but the best authorities on the subject assert no pronounced reductions are probable. This is explained by money conditions, the foreign demand, and the marked curtailment of production of building materials during the war. Prof. Fisher of Yale University has issued a statement in which he says the country is on a new

price level from which there will be no general recession.

Many farmers have been unable to get materials and labor for barns, silos, houses and other improvements during the war. The farmer who at once avails of the labor supply and gets his improvement work under way, in the long run, may prove to be the prudent business man, for there is reason to believe that farmers who delay in the hope of materially reduced construction costs will have been deprived of the use of these improvements and in the end be forced to pay approximately the building prices now prevailing.

In several states, among them Missouri, Oregon and Colorado, silo building campaigns are being carried on by the agriculture colleges. In Wisconsin there is a milk house campaign being vigorously prosecuted in the dairy districts, while in Illinois farmers are being urged to build feeding floors. Other campaigns for farm improvements are on in Nebraska, Kansas, Minnesota, South Dakota, Kentucky, Ohio and in localities in Texas and Iowa. While many of these are being conducted by building interests, the Division of Public Works and Construction Development of the U. S. Department of Labor is interested in seeing them successfully carried out because the Division realizes such activities on the farms are bound to have a beneficial effect on general business conditions.

The farmers of the country should have an unusual interest in road building at this time. If farming is to continue on its present profitable level, there must be no business stagnation in the country and the vast road building projects in the various states are destined to exert a profound influence in keeping "business as usual" or "better than usual." Road building creates a demand for materials and absorbs labor and the labor problem is a serious one at present and will continue serious until American industries have readjusted themselves to peace production on a scale to meet the augmented demand of America and Europe.

Would Prevent Sand Dredging

Gary, Indiana, which recently acquired through the annexation of Miller, four additional miles of lake front, is deeply interested in the protection of that lake front from the depredations of the fleet of dredgers and sandsuckers which for years has been in the habit of taking sand from Lake Michigan adjacent to the beach.

For that reason the people of this city, and especially the members of the Gary park board, are urging the passage of the Tuthill bill which forbids such dredging and imposes a heavy penalty upon the violators.

The bill has passed the house but is encountering snags in the senate.

Members of the Michigan City Chamber of Commerce were in Indianapolis this week urging the passage of the bill which was introduced early in the session by Representative Tuthill of Laporte county. The Tuthill bill makes it a felony to take sand by a dredge or sandsucker from the bed of Lake Michigan within the state of Indiana for private use. The law would protect the lake front beach in the newly annexed town of Miller where it is proposed to create a great Gary lake front park and where the removal of the sand would seriously damage the character of the bathing beach.

The Tuthill bill, which fixes a penalty of from two to ten years' imprisonment and disfranchisement and which went through the house February 20 by the vote of 81 to 3, has been objected to in the senate committee on rights and privileges to which it was referred on the ground that the penalty is too severe.

Cut Costs—Control Profits

By Herbert E. Mitler, M.E.

EDITORIAL NOTE—With increased prices for building materials and labor, accurate estimating becomes daily more important to all contractors. Every contractor wants to make more money. One of the best ways for him to do this is to figure and to keep an accurate record of all costs by means of an up-to-date estimating system.

In discussing this subject, which is the vital thing in the contracting and building business, it will be my endeavor to bear in mind that the conditions of the readers vary. The contractors are divided into two classes: First, those who do all of their own work, employing the labor directly, except for the mechanical work, viz.: Plumbing, steamfitting, electrical work and elevators; second, those who do no part of their own work, except perhaps excavating, carpentry and masonry and sub-let the remainder of the work to men who make a specialty of the various trades.

It is self-evident that contractors who do their own work must have their estimated quantities as accurately determined as possible. But the contractor who sub-lets the greater part of his work must also have this data to check up the figures submitted by the sub-contractors. Estimating is, therefore, important to all contractors.

The contracting business must now be conducted like any other well-organized manufacturing concern. The contractor must know the probable cost of production. This means that quantities and unit prices must be accurately estimated. Records facilitate, assist and govern to a considerable extent this accuracy.

The keynote of estimating is system. System enables the contractor to determine his quantities and

In making out the reports there is too much tendency on the part of actual construction men to guess instead of measure quantities. Train these men to habits of carefulness and you will find that your office and field men co-operate more closely. It may require considerable patience in the beginning to achieve results, but this pays.

Office Equipment

It is of prime importance, in conducting a contracting business, that the office should be properly and efficiently equipped, although not necessarily expensive. Certain things are as necessary for this business as are desks, chairs, telephone, etc., for any other business.

I will show in this article illustrations and give approximate costs of the equipment which I consider necessary as a minimum. This equipment is relatively inexpensive from the standpoint of outlay and extremely moderate from the standpoint of the enormous gain by use. It is self-evident that having your records placed so they can be readily reached saves a great deal of valuable time of expensive help or, in the case of small offices, of members of the firm.

The equipment which is necessary consists of: Drawing and estimating table, blueprint cabinet, document files, card index files with markers, letter and specification files with markers.

This equipment should be of a character which will permit of ready expansion so that, as the business



This Rack Can Be Fastened to Wall or Ceiling. It Is Then Out of the Way.



A Vertical Blueprint File Having an Extension Board on Which Prints May Be Examined.

grows and the records become more numerous, the filing systems will not become too cumbersome and unwieldy.

Drawing and Estimating Table

In regard to drawing and estimating table, it is not necessary to show any cut, as every contractor is familiar with these tables, which are made in various forms. It is, however, advisable to have the estimating table so that it can be set up at an angle. This slope makes working at the table more convenient, which is appreciated, especially if many hours are spent over the board. Working is thus made much easier.

Blueprint Cabinet

The personal equation enters into the decision of choosing the blueprint cabinet. These cabinets are of two kinds, as illustrated—those which receive the prints rolled up and those which hold the prints vertically. The former type is very easy for the contractor to build.

A very satisfactory form of file is one approximately 5 feet high, 3 feet wide and 2 feet deep, having three 1x1-in. posts in the depth, seven 1x1-in. posts in the width and ten 1x1-in. posts in the height, in that way

costs at any stage of the work. This involves proper and simple office equipment, as well as proper forms for office and field work, so that the labor of carrying on the business is reduced to the minimum. It is also necessary that trained and systematic superintendents and assistants be used on your work to insure reports being kept properly.

making each opening approximately $4\frac{1}{2} \times 4\frac{1}{2}$ -in. This type of file can be hung on the wall, then out of the way, while the one with the vertical holders must use floor space.

The approximate cost of the vertical blueprint file, which has the drawing and estimating table attached, is \$56. The approximate total cost for making the file for holding the prints in rolls with a separate estimating table would be \$35. It must be borne in mind that the vertical filing system is a cleaner way as the prints do not become covered with dust.

There should be two document files. The reason for this is to follow a system of forms which I shall give in succeeding articles. One document file should hold the estimate envelopes and the other the contract envelopes. The approximate cost of these files is \$4.80.

I suggest the use of card index files containing two drawers. Both should have markers from A to Z, one to be used for the list of contractors or material men from whom goods may be purchased and the other to be used for the list of quotations for standard materials, discounts, and other price information which may be required.

In connection with the latter, many contractors use a book. This system, however, is a great disadvantage in that the book is easily carried in one's pocket until lost. Also, it lacks flexibility unless the loose leaf book is used. Then there is danger that the leaves may become torn out and the information lost. The approximate cost of these files with markers is \$7.20.

There should be a minimum of three letter files, all of them to contain markers. One file should be for the estimating sheets, which are of letter size and will be shown in a subsequent article. The markers for this file should be for the various kinds of contracts awarded, such as carpentry, structural steel, steam-fitting, etc.

In the second file (which should have markers made the same as described) the correspondence with the various contractors can be filed in separate folders. The alphabetical system of filing correspondence with contractors is one in which a great deal of time is lost seeking information. If John Smith is a steamfitter on a particular piece of work and the manager wishes to refer to the correspondence, the office boy simply goes to the file, looks up steamfitting, and there finds a folder marked "John Smith" with all the correspondence. It is, therefore, readily seen that a great deal of time is saved as against filing all office correspondence alphabetically and having the office boy look through all the letters filed under "S" for correspondence with John Smith.

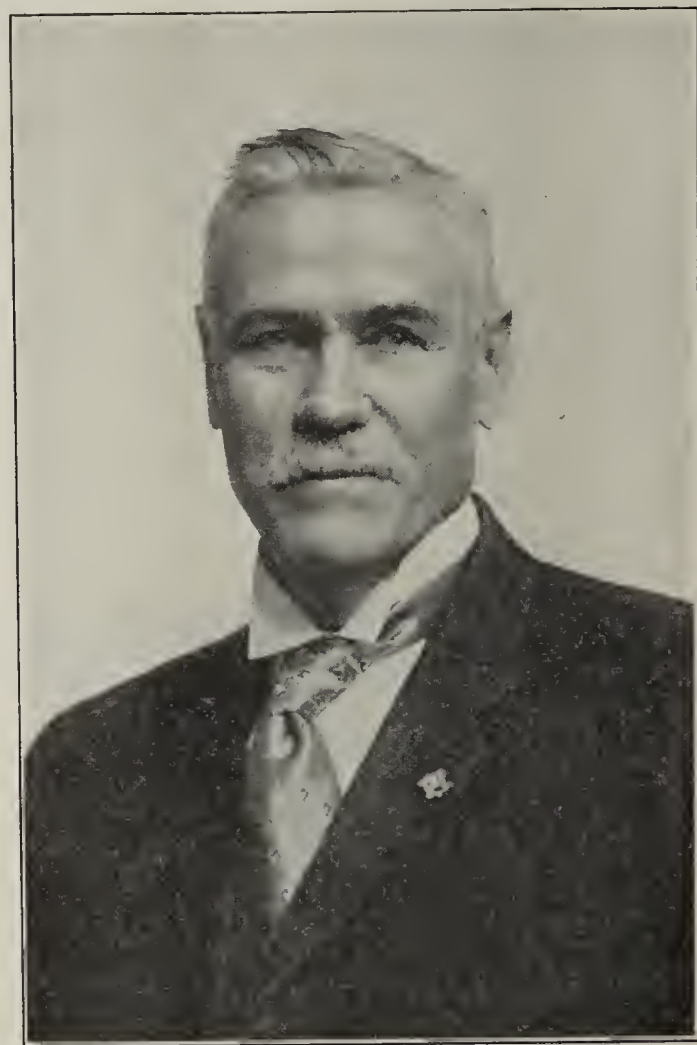
The third file should have the same markers and it is to be used for filing of specifications of the various trades. The approximate cost of the group of three files and the markers is \$33.50.

This gives you an equipment from which your business can be operated properly and which will allow of ready expansion in an office. The initial cost of this equipment is not nearly of as great importance as the results which will be obtained from using it.

Cement Expert Dies

Prof. Rolla C. Carpenter, an engineer and educator, to whom many of the successful men of industry owe their inspiration, died at his home last month, in Ithaca, N. Y. Professor Carpenter, through his indefatigable labors, left a deep impression on mechanical engineering developments in this country. Early in life he attained an enviable reputation as an engineering expert and was always the center of a large

group who sought his advice or were desirous of studying under his direction. He was professor of experimental engineering at Cornell University from 1895. From his earliest days in this capacity he stood apart from most of the teaching staff of Sibley College of that university, as well as other technical schools, in that he was widely regarded as having a close contact with outside affairs, and his instruction on the theory of engineering was therefore tempered by the practical conditions of the industrial world. He gained authoritative positions in the field of steam engineering, in heating and ventilation, in cement manufacture and in the automobile field. His voluminous contributions to engineering literature were devoted to these branches of engineering. Besides numerous valuable papers, he was the author of books which have remained as standard authorities and as text books, in-



The Late Prof. R. E. Carpenter.

cluding his "Experimental Engineering," "Heating and Ventilation," and "The Gas Engine." He was a member of many technical and national societies, including the societies of civil engineering, mechanical engineering, mining engineering, heating and ventilating engineering, refrigerating engineering and automotive engineering. He was also a member of the American Society for Testing Materials and a member of the Engineers' Club of New York. He was also a noted inventor.

Clinchfield Cement Co.

Edward S. Hiner has been appointed sales representative of the Clinchfield Portland Cement Corporation, Kingsport, Tenn., with offices at 1305 Union Trust Building, Cincinnati, O., succeeding Morris M. Hunter, who became general sales manager of the company at Kingsport.

Saturation of Concrete Reduces Strength and Elasticity

Tests Show That Moisture Content of Specimens Serves to Counteract the Benefits of Moist Curing

By M. B. LAGGARD

Concrete Engineer, Emergency Fleet Corporation, Philadelphia

There are three stages in the manufacture of concrete in which water enters as a vital element in the strength of the material. First, at the time of casting, when the materials are mixed; second, during the period of curing, when the concrete is in place; and third, after the concrete has attained sufficient strength to sustain the designed load. The danger of loss of strength from too much water in the first stage and not enough water in the second has been frequently brought to the attention of the engineering profession. However, the effect of the presence of water as a distinctly foreign element in concrete is a question upon which there are still very little published data, but of which clear knowledge must be had, in order to permit of the proper analysis of a concrete structure. Tests made in the experimental engineering laboratory of the University of Minnesota show that this continued moisture tends to reduce both strength and elasticity.

The tests were confined mostly to compression tests in which standard cylinders 8 inches in diameter and 16 inches high were used. Deformations were taken with a four-dial compressometer estimating readings to 0.0001 inch over a gage line of 10 inches. The loads were applied in increments of 4,000 pounds total, at regular intervals of time, the latter element having been recognized as a vital factor in the test of concrete specimens.

The curves shown in Fig. 1 represent the results of a series of compression tests of 1:2:4 trap-rock concrete specimens, made to show the variation in elasticity and strength of wet and dry concrete in the early stages of curing. All of the tests were made at the age of six weeks. It will be noticed that in all cases the specimens which had been wet the longest show

the highest values for the initial modulus of elasticity, while the strength is a maximum with one of the specimens which has been wet for a short period at the beginning and has then been allowed to dry out before testing. Thus specimen E, which has been cured two weeks under wet sacks and four weeks in air, shows the highest strength value, although both A and B, cured in water, and C and D, cured under wet sacks for longer periods of time, show higher values for the initial modulus of elasticity.

Fig. 2 gives the results of another series of tests made about a year earlier, by an entirely different group of observers, where gravel was used as coarse aggregate instead of trap rock, but the results of which show the same peculiarities. The wet cylinder has the highest initial modulus, and one of the intermediate cylinders shows the greatest value for the ultimate compressive strength. Without considering the degree of saturation of cylinders at the time of test, the strengths should increase with the increased time of curing in water, and the values for the modulus should also increase accordingly. However, the fact that this does not take place shows that there is some other element to be considered which affects these two properties.

The effect of this other element may also be noticed in the curves of Fig. 3, which show the results of a transverse test of a beam of solid sandstone. The readings in this case were taken with a 2-inch Berry strain gage directly over the load, which was applied at the center. The tests were made under two conditions: First, when the beam was thoroughly dried, having been kept in a dry place for several years after quarrying; and second, after it had been immersed in

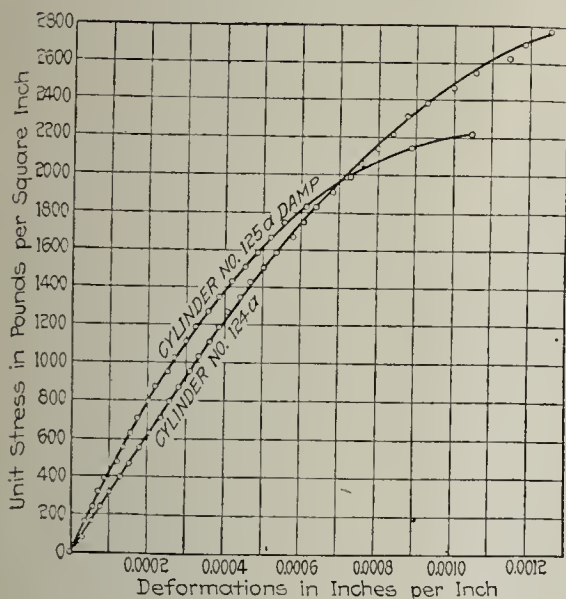


FIG. 4. COMPRESSION TESTS OF 8 x 16 IN. 1 : 2 : 4 LIMESTONE CONCRETE. AGE = 189 DAYS

Data: Cylinder No. 124a cured two weeks under wet sacks, then open to air of laboratory until tested. $E = 3,078,000$. Ultimate Strength = 3310 lb. per square inch.
Cylinder No. 125a cured under wet sacks until tested. $E = 4,150,000$. Ultimate Strength = 2480 lb. per square inch.

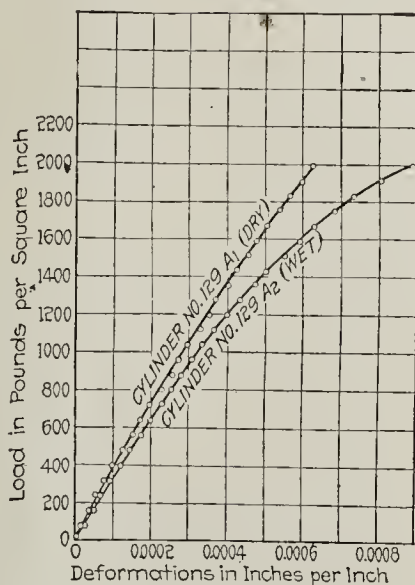


FIG. 5. EFFECT ON ELASTICITY OF MOISTURE SHOWN BY TESTS ON 8 x 16-IN. 1 : 2 : 4 LIMESTONE CONCRETE

Data: Cylinder No. 129A. Age = 469 days. Cured 7 days under wet sacks and 462 days in air. E at 600 lb. per square inch = 3,700,000. Ult. Comp. Strength = 3630 lb. per square inch.
Cylinder No. 129 A2. Age = 462 days. Cured 7 days under wet sacks, 434 days in air and 21 days in water. E at 600 lb. per square inch = 3,150,000. Ult. Comp. Str. = 2340 lb. per square inch.

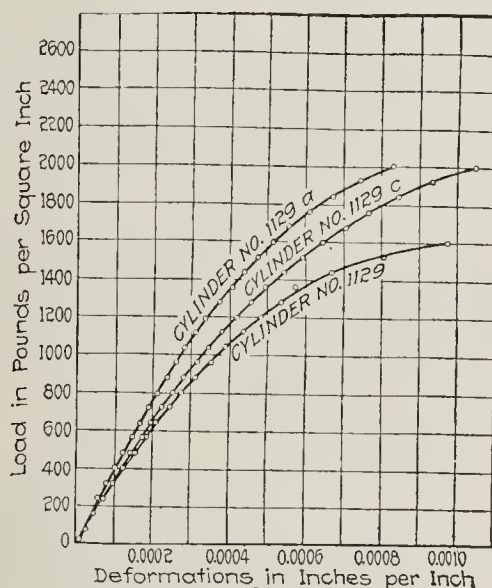


FIG. 6. COMPRESSION TESTS OF 8 x 16 IN. CYLINDERS, 1 : 2 : 4 LIMESTONE CONCRETE

Cyl. No.	TIME IN DAYS			Age	Strength, lb. per sq. in.
	Under Wet Sacks	In Air	Under Wet Sacks		
1129-a	102			102	2150
1129-c	7	95		102	2350
1129	7	90	12	109	1670

water for a period of seven days. Here the question of age is of no importance. The effect of water in the specimen at the time of test is at once noticed in the reduction of strength of the specimen. This appears

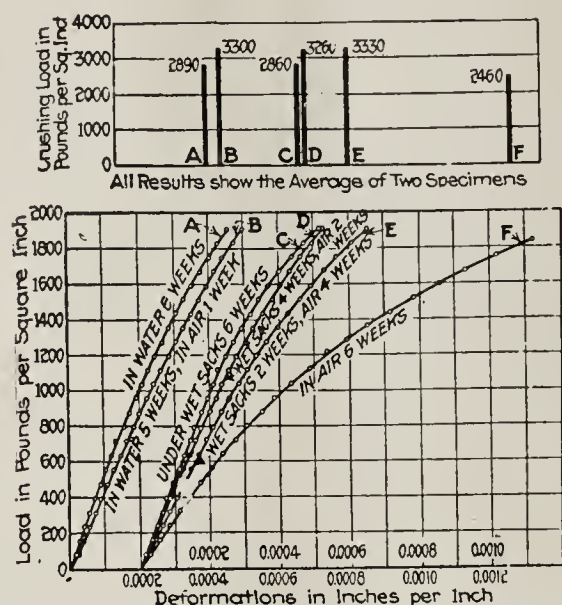


FIG. 1. COMPRESSION TESTS OF 8 x 16-IN. CYLINDERS OF 1:2:4 TRAP-ROCK CONCRETE AT AGE SIX WEEKS

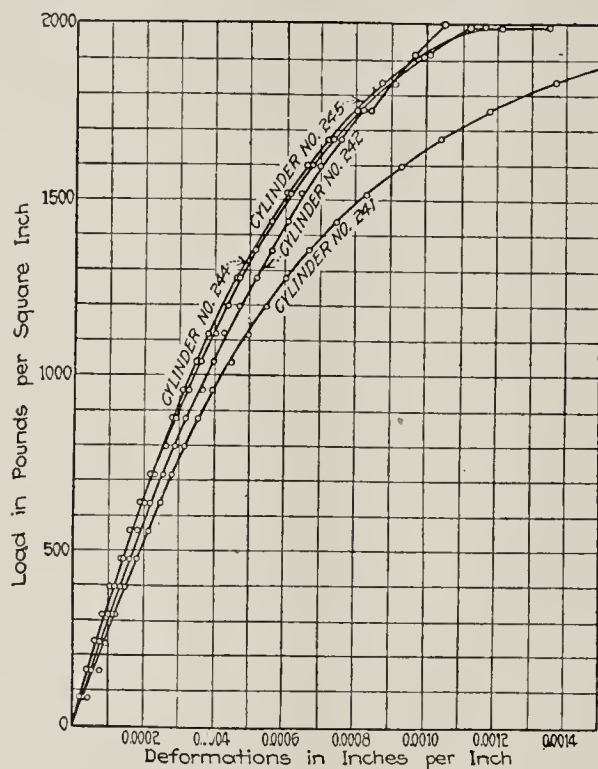


FIG. 2. EFFECT OF MOISTURE ON MODULUS OF ELASTICITY OF GRAVEL CONCRETE. MIX 1 : 2 : 4, AGE EIGHT WEEKS

Cylinder No.	Time in Weeks Under Sacks	Time in Weeks In Air	Secant Modulus at 700 lb. per sq. in.	Ultimate Strength lb. per sq. in.
241	1	7	2,530,000	1989
242	3	5	2,790,000	2434
244	7	1	3,000,000	2250
245	8	0	3,170,000	2069

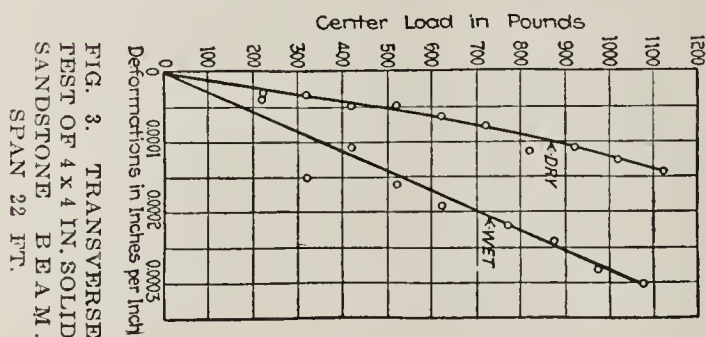


FIG. 3. TRANSVERSE TEST OF 4 x 4 IN. SOLID SANDSTONE BEAM. SPAN 22 FT.

to be exactly what has taken place in the concrete specimens of Figs. 1 and 2. The specimens which had been kept in water up to the time of test were thoroughly saturated and hence showed a much lower strength than would be expected with this curing while those which had been cured under water for a period of time and then exposed to the air for various periods before testing were more or less dried out and hence did not show such a marked reduction. The specimens which were cured entirely in air were dry at the time of test and showed the normal strength expected. This variation in the percentage of moisture content is shown by the weights of the specimens given in the table. Thus the reduction in strength in any particular case appears to vary with the amount of saturation at the time of testing.

The same thing has occurred, in all probability, in the case of the initial modulus of elasticity, except that the reduction in modulus due to the presence of water was not sufficient to overcome the increase in modulus due to better curing.

The effect at advanced ages is shown in the curves of Figs. 4 and 5. Fig. 4 represents approximately the two extremes of the treatment shown in Figs. 1 and 2, extended over a much longer period of time, the wet cylinder in this case having been 189 days under wet sacks and the dry cylinder having been exposed to the air for the same length of time with the exception of the first two weeks, when it was kept under wet sacks. The results, however, are the same as in the case of concrete six weeks old, and point to the same conclusions.

Fig. 5 shows results from two specimens which were kept under wet sacks for seven days and then left open to the air for more than a year, after which one was placed in water for three weeks and then tested wet, while the other was tested at the same age dry. Both strength and modulus show a decided drop in the wet cylinder, the reduction in strength exceeding 35 per cent.

Results from another group of cylinders are shown in Fig. 6. In this group specimen No. 1129a was kept wet from the time it was cast, No. 1129c was kept dry after first being under wet sacks for a week, and No. 1129 was cured in the same manner as No. 1129c, except that it was placed in water the last 12 days and

Table Showing Comparative Weights of 1:2:4 Trap-Rock Concrete, Age Six Weeks

Mark	In Water	Under Wet Sacks	In Air	Weight Lb. per Cu. Ft.
A	6	..	..	160.7
B	5	..	1	159.2
C	..	6	..	160.5
D	..	4	2	158.0
E	..	2	4	156.9
F	..	..	6	154.5

tested wet. The difference between 1129a and 1129 is in the curing, the effect of which shows up in the lower values of both the strength and the modulus of the latter. Cylinders 1129c and 1129, being cured alike except for the last few days, show clearly the difference due to the presence of water, the wet one having both a lower strength and a lower modulus.

The outstanding features which the writer has observed in regard to these tests are enumerated below:

First, moisture in concrete reduces its strength and modulus of elasticity. This is in accord with the results found by Prof. J. L. Van Ornum in regard to strength, as reported in the Transactions of the American Society of Civil Engineers, Vol. 77, December, 1914.

Second, the effect upon the modulus is not as pronounced as the effect upon the strength.

Third, the reduction in strength due to saturation by water which has been present in concrete from the time of casting may be more than sufficient to overcome the increase in strength due to better curing.

Thus we find it possible to have two concrete specimens having the same modulus of elasticity and yet differing widely in ultimate compressive strength, and vice versa. The effect of this will be seen by referring to specimens Nos. 125a and 124a of Fig. 4 and applying to each the method for determining the modulus of elasticity outlined by the Joint Committee on Concrete and Reinforced Concrete in 1917. According to this method Cylinder No. 124a would fall in class D with a modulus of 3,000,000, which is very nearly the true value found by actual measurements, while Cylinder No. 125a would fall in class C with a computed modulus of 2,500,000, whereas the measured modulus is about 66 per cent in excess of this amount. Subsequent drying would no doubt have put the latter specimen high into class D, while saturation would in all probability have dropped Cylinder 124a into class C, thus reversing the original condition.

From these results it is seen that the effect of saturation clearly must be recognized in an analysis of test data, and if reductions in strength as high as that shown in Fig. 6 can be expected in practice, the possibility of such a weakening must be taken into account in the design.

The writer wishes to express his appreciation to Prof. F. R. McMillan of the University of Minnesota, now in charge of extensometer tests of concrete ships for the United States Emergency Fleet Corporation, for the loan of data and for suggestions and assistance in the making of these tests.

Pennsylvania Railroad's Concrete Coaling Plant at Pitcairn, Pa.

The original coaling and sanding plant of the Pennsylvania Railroad at Pitcairn, Pa., was designed for timber construction and built by the Roberts & Schaefer Co., Engineers and Contractors, Chicago, and completed in the fall of 1917. Shortly after it was taken over by the railroad, it was destroyed by fire due, it is believed, to incendiary origin. As the railroad yards at Pitcairn are among the most important ones in the vicinity of Pitts-

burgh, quick rebuilding of this plant became a war measure.

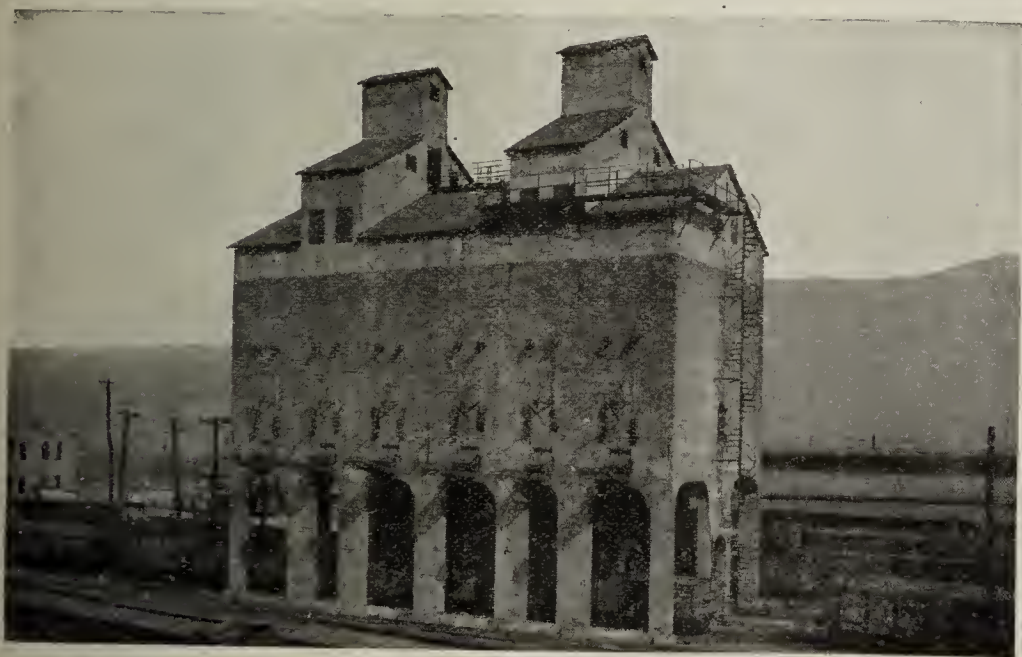
Fortunately the concrete foundations installed for the original timber structure were designed sufficiently heavy to support a concrete structure and the Pennsylvania Railroad decided to rebuild of reinforced concrete. Contract to rebuild was awarded to the Roberts & Schaefer Co., and the design called for a structure to practically duplicate in concrete the timber one burned.

The original as well as the new plant are shown in accompanying illustrations. The latter was completed late in the summer of 1918 and is now in successful service, coaling and sanding an average of considerably more than 200 engines a day.

The plant is designed to coal on two outside tracks and is equipped with 12 radial gates and sway spouts for direct coaling of engines. Coal is received on two tracks passing under the structure and discharged into four track hoppers so that four cars may be unloaded at once. This is necessary as often the coal reaching the plant in winter is frozen solid in the cars and this reduces speed of unloading. Coal is elevated in automatic counter-balanced buckets, electrically operated, and affording hoisting capacity of 150 tons per hour. The plant is equipped with a gravity sand plant and patent steam sand dryers for elevating, storing, drying and placing the dry sand on locomotives without hand labor. The plant has a storage capacity of 1,200 tons of bituminous coal.

The Greenville Gravel Company

Growing from a small sand hill to five corporations with a capital stock of nearly \$1,500,000 is the history of the Greenville Gravel Co., of Greenville, O., one of whose plants is located near Richmond, Ind. In 1900 two men, W. O. Patty and Fred Coppock, started the business by leasing a gravel pit west of Greenville, which is near the state line, and loading the gravel into cars with wheelbarrows. In this manner the output would not exceed five cars a day. Within three years improvements were made and more land was bought. A company was formed and they were loading fifty cars a day. Today there are five companies and ten large plants resulting from the wheelbarrow plant of eighteen years ago with practically no investment whatsoever.



Concrete Coaling and Sanding Plant at Pitcairn, Pa., Built to Replace Burned Wooden Structure.

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View of the Quarry of the Bethlehem Mines Corporation, Steelton, Pa., Before the "Shot."

Bethlehem Mines Corporation Shoot 225,000 Tons of Stone in One Blast

The "Clipper" Big-Hole Drill an Economic Factor

In all the range of recent quarry improvements perhaps there is none more radical or more valuable than that of the recently developed practice of drilling big holes with well drills or cable drill method for the shooting of big shots, and so diminishing the danger of basting to a minimum, while at the same time the efficiency of the initial explosive is developed to its highest attainment. Naturally the big-hole drill is most efficacious where the quarry face can be worked in a long straight stretch. The use of large drills is now in quite common use and is constantly increasing among quarrymen. In fact the growing tendency is for large machinery of all kinds, such as mammoth crushers, steam shovels, etc. Volume is what is wanted nowadays.

The advantages of the big drill over the piston driven drill are numerous. By carrying the holes the full depth of the face the stone is loaded and treated on one working floor. It eliminates the cost of bench cleaning. Loading operations are less frequent, thus lessening the danger. Stone can be shot down in greater volume and in better shape, making it economical to use a steam shovel. No bench cleaning makes it safer for the men. It is cheaper and can be used in outlying and temporary operations where the cost of

installing a power plant would be out of the question. It permits a greater spacing of bore holes and eliminates the necessity of "squibbing" or springing. Of course, every practical man knows that the ideal proposition in blasting is to lift the stone, partially turn it over and drop it again so that it is in fit condition to be reclaimed by a steam shovel. Just to topple over the face of the quarry or roll it out is not enough. The shot must be so placed and so designed as to raise the lift and drop it again so as to shatter and break up the rock as much as possible, and the lower down this can be done the less damage there is from flying spawls, which always come from the top of the dead rock.

An interesting and notable "shot" recently made at the Steelton, Pa., quarry of the Bethlehem Mines Corporation, is told by Mr. G. H. Muth, superintendent of this quarry, which furnishes limestone to the Bethlehem Steel works. He has the following to say regarding this large and successful blast:

"The blast consisted of seventy-nine 6 inch diameter blast drill holes averaging 96.8 feet in depth, the shallowest of which was 64 feet and the deepest 120 feet. The holes were drilled by means of three Electric Traction "Clipper" Blast Hole Drilling Machines, as manufactured by The Loomis Machine Company. Tiffin,



View of the Quarry After the "Shot," Showing Shattered and Broken Stone Ready for the Steam Shovels, Enough Stone to Keep the Bethlehem Steel Plant Supplied for Four Months.

Ohio, and were operated by one man to each machine and a master driller who had entire charge of drilling. The drilling time extended over a period of four months with the average working time per machine of 260 hours per month. Total feet drilled 7,648.

"At 2:00 a. m. on the day of the blast, we commenced pumping the holes by means of two gasoline driven outfits of our own design and make. At seven o'clock four 2-men gangs commenced loading and by twelve o'clock noon they had sixty-nine of the seventy-nine holes completely finished. In addition to the above mentioned loading crews, we had four men slitting the 5 inch by 10 inch cartridge in order to expedite the loading, and also six men tamping the holes with 'dust' taken from our crushing plant. This material is finely graded and consequently 'free running' and our experience has led us to believe that it is as desirable a material that can be used for 'stemming' holes. The Penna. Trojan Powder Company's products we used, an average of six boxes of 50 per cent in the bottom of each hole and an average of nine boxes of 40 per cent to each hole. Into all the holes of this blast, we loaded a total of 23,600 pounds of 50 per cent powder and 35,250 pounds of 40 per cent powder.

"No. 6 Cotton Countering Cordeau-Bickford detonating fuse was used in each hole and No. 6 Plain for the 'lead.' Seventy-seven hundred feet of the first mentioned fuse was used and 1,400 feet of the plain. At 2:30 p. m. the blast was completely loaded and ready to be thrown down, which we feel was excellent load-

ing' when the number of men employed and the weather conditions were all taken into consideration.

"Messrs. Frank Leonard and Dave Maddox, technical experts of the Penna. Trojan Powder Company, directed the loading and Mr. M. L. Jacobs, general superintendent of all quarries of the Bethlehem Mines Corporation, was one of the visitors that observed the 'shot.'

"Two rows of holes were drilled, the first of which was 25 feet back from the face of the quarry and the holes 19 feet apart on centers. The second row was 14 feet behind this and staggered between the holes of the first row. Approximately 225,000 tons were thrown down by this 'shot,' which resolves itself into about 3.8 tons per pound of powder and 29 tons per foot of hole drilled.

"The illustrations shown herewith are views of the face before the 'shot' and the other one immediately afterward."

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Hard Surface Roads and the Auto Truck

The Roads Are Supplementing the Railroads—By H. W.

Eldridge, Member American Concrete Institute,

New York City

During the war we had to keep the steady stream of supplies moving to the front. Most of us had a vague idea of what this problem meant in France—docks, piers, railways, canals, highways, refrigeration plants, warehouses and hundreds of other mediums by which the supplies were transported from the ships to our troops. Another link in this chain of supply movement was the shipping from our coast to the French coast with all its hazards, and still another link which was not given as much study as either of the other links mentioned, but of just as great importance, was the transportation of supplies from the points of production in the interior states of our country to the points of shipping on our Atlantic coast.

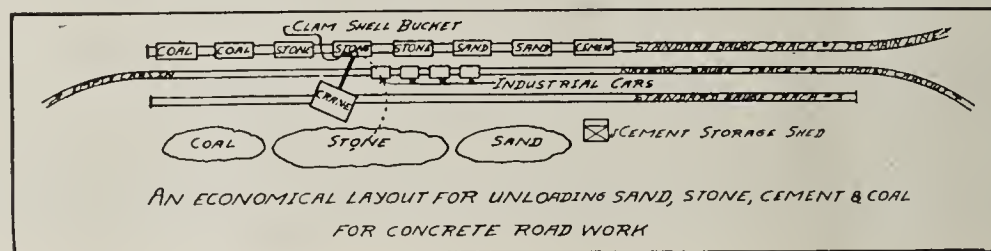
As this has been proven a link of the chain, it is of as great importance as any other link. It is with this question that we wish to deal.

The supplies were produced in some certain section of the country and were in many cases loaded into freight cars and delivered to the shipping points on the Atlantic coast. There has been another medium developed since

eye" of the foreman. The mechanical finish is a real finish and when a contractor has done this work properly he knows there will be no comeback as to the appearance or wearing qualities of the surface. In other words, when a concrete road job is finished, it IS finished. All you contractors that have built other roads know that this does not hold true with the other types and you all can probably recall some sad experience in this connection.

The time is opportune to get out among your representative citizens and promote good roads which are both essential to our future industrial needs. The demand for roads is apparent as has been shown. The roads will be built. However, you can undoubtedly start the officials with whom you are acquainted thinking along concrete lines. You will find that your influence in the community is greater than you thought and the first thing you know you may be handling substantial concrete road jobs. Without a doubt, good honest promotion exerted at once will prove a financial satisfaction to the wide awake American contractor.

The art of concrete road construction, as it affects the



the outbreak of the war for this same service—namely, the hard surfaced road and the auto truck. The roads are supplementing the railroads. Around all cities which are railroad centers, there exists a network of roads. These roads are used for the transportation of manufactured commodities from the outlying place of manufacture to a central shipping point in the city. To relieve the congested railroads, many shipments have been made by motor truck from the place of manufacture to the coast shipping point, making use of the through route roads. It is to be expected that there will be an increased demand for roads as long as the war lasts and even after the cessation of hostilities.

Although roads have not been placed upon as high a standard by our government as such other transportation facilities as ships, canals and railroads, the time is coming when this will take place. Hard surfaced roads are here to stay as an economic necessity to both war and peace operations. In the two-year period 1915-17 the number of motor vehicles in this country increased by over 100 per cent. The 1915 registration was 2,445,664, while the 1917 registration was 5,148,063. This increase gives us some idea of what to expect in the future. There must be built a great number of hard surfaced roads each year to carry this ever-increasing traffic.

Among the types of hard surfaced roads which have proven satisfactory under the modern heavy and speedy traffic, is the concrete road. The concrete road is the most profitable type of road construction from the contractor's viewpoint. The present day methods of concrete road construction have reduced the labor to a minimum (by the use of machinery) and have made it possible to cause the contractor to feel entirely satisfied over a completed job as the finish is mechanical. It is unlike some of the other types which depend largely upon the "good

finances of the contractor, is largely dependent upon the methods used in handling the construction materials. Of course it can be said that this is true of all building operations. However, it is undoubtedly a greater factor in road construction than in any other construction work.

It is a well-known fact that concrete road contracts are increasing in size each year. During the experimental stages of concrete road development the contracts which were awarded rarely exceeded over one mile in length. At that time a contractor could not afford to invest a large sum of money in equipment. Under present conditions, contracts are awarded for from 3 to 15 miles of road at one letting. This condition makes it justifiable for a contractor to invest heavily in plant, and enables him to charge out this investment on the first few contracts which are awarded to him.

This type of construction has developed into a problem of hauling and handling the cement, sand and stone. The excavation, mixing and placing, finishing and curing, are matters of secondary importance to the contractor. It might be interesting to outline a few of the modern methods used for hauling and placing the materials.

The first problem in handling the materials is the unloading of the cement, sand and stone from the standard gauge railroad cars. This can be accomplished in a very economical way by the use of a small locomotive crane using a clam-shell bucket. For this arrangement it is quite important to select a railroad siding which is straight for some distance, although it would be possible to carry on the same operation on a curved track. You will note on the sketch that track No. 1 is a standard gauge siding. On this track the loaded cars are rolled in for unloading. Track No. 3 is standard gauge for the use of the locomotive crane. Track No. 2 is a narrow gauge for industrial cars. Now the operation is simply this: The locomotive

crane using a clam-shell bucket picks up a load of sand, gravel or stone from the cars and deposits it directly into the industrial cars on track No. 2, or if there are no cars on track No. 2, the crane completes the semicircle and deposits the material on the stock pile. The industrial cars when loaded are transported to the mixer. This method has been used to great advantage, and especially when it is desired to cut down demurrage charges, this makes a very flexible layout. Material has been handled in this way for the low cost of 7c per ton-mile. It is easy to see that a very small number of men are needed to keep this outfit in operation. The cement is wheeled out of the box-cars directly on to the flat industrial cars. Of course, it is entirely possible to substitute for track No. 2 a road on which wagons or motor trucks could be used in the same manner as the industrial cars. This change would reduce the efficiency materially. However, it is sometimes impracticable to use narrow gauge tracks along the road which you are building.

You are probably familiar with the vast number of methods for unloading materials which have been so intensely developed during these days of labor shortage. For very small jobs where there is not a great yardage of material to be handled, the steel hopper has been used with much success. The hopper is hung on the side of the car and loaded by hand labor with either stone or sand. The auto truck or wagon is driven alongside the car and under the hopper. The hopper is fitted with a bottom dump gate; this gate is released by the truck driver and the full load slides from the hopper into the truck, thereby avoiding delay for the truck. The advantage of this method is that the trucks are maintained in constant operation. There is a very marked saving over the old hand unloading method. For the medium-sized job it is advisable to use the pit and conveyor method. The cars are run over a pit of suitable size and dumped. A bucket conveyor is used to load the material either into a hopper above the ground or directly into the wagons or trucks. Of course, the use of a hopper has the same advantages as outlined for small hoppers, which have been explained.

The methods of hauling have also been developed in a very wide and diversified way. If the entire job is in fairly level country and the shoulders are of sufficient width, a narrow gauge railroad can be used to advantage. The loaded $1\frac{1}{2}$ cubic yard industrial dump cars are run out in trains on a 24-inch gauge track and can either be dumped directly into the skip of the concrete mixer or in longitudinal windrows on the subgrade. This method can be used only on special jobs as outlined where the natural contour of the country is comparatively level. For transporting the material from the unloading yard or railroad siding, the motor truck has become most popular and is probably the most flexible method. One of the recent developments in this connection is the use of a rear dump motor truck with the body divided into compartments. The body of the truck is divided into five equal boxes with a top-hung swinging door between each. Sufficient cement, sand and stone for one batch are loaded into each compartment at the unloading siding. The truck is then run out to the point of concreting and backed up to the concrete mixer's skip. There is a slight delay at this point for the truck, as the four batches are mixed and deposited before the truck dumps the last box. This method has a great many advantages. The materials are accurately proportioned and do not come in contact with the subgrade. On a number of concrete road operations the materials are dumped from the motor trucks directly on the subgrade. It has been found almost impossible to avoid the dirt and clay becoming mixed with the sand and gravel and causing the concrete to be of an inferior quality. Therefore, depositing the materials on the sub-

grade is a practice which is rapidly disappearing on jobs which are being efficiently managed. The old method of hauling the materials from the subgrade to the mixer by wheelbarrows is almost entirely out of use due to the large number of men needed for this work. A new machine has recently been put in use for this operation. This machine is mounted on wide tired wheels, is self-propelling and is of sufficient length (60 feet) to reach from the materials on the subgrade to the concrete mixer skip. The materials are shoveled by hand into small measuring hoppers and are dumped on to a belt conveyor which carries them to the mixer skip. This machine has reduced the required number of men to a minimum and is giving very good results on several jobs at this time.

Concrete has always been thought of as a mixture of cement, sand and pebbles or crushed stone. It has been found recently that we have been disregarding one of the most important constituent materials—the water. It has been shown by laboratory experiment that a concrete mixed with 7.5 gallons of water (1 cubic foot) to one sack of cement (allowance being made for the absorption of aggregate) gave a strength of 2,000 pounds per square inch.

Using 6 gallons of water per sack of cement 3,000 pounds per square inch.

Using 5.6 gallons of water per sack of cement, 3,300 pounds per square inch.

These results indicate that when a mixture of 1:2:3 is used the water content should be from $5\frac{1}{2}$ to 6 gallons per sack of cement. This data will surely emphasize the fact that more care should be used in measuring the amount of water used.

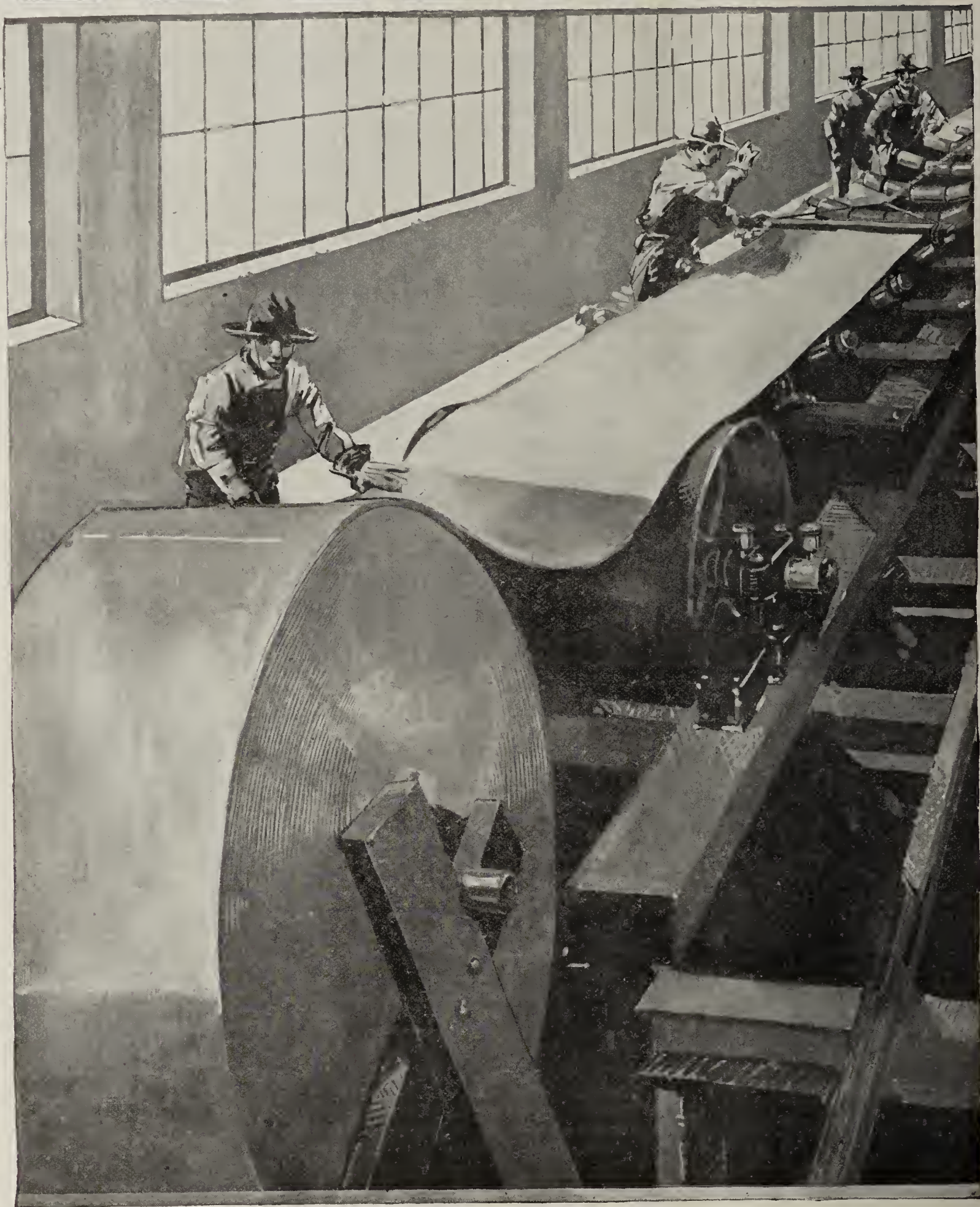
A word in this connection regarding the methods of depositing the concrete. You will find that 5.6 gallons of water per sack of cement which gave the highest strength value, produces a concrete that is much dryer than the concrete you are accustomed to handle. It will be found necessary to use a concrete paving mixer fitted with a boom and bucket, as concrete of the proper consistency will not flow in a chute.

You are all familiar with the work after the concrete has been deposited on the subgrade. In order to obtain a true surface, a template or strike-board is used. The strike-board is followed by either a finishing machine or the belt and roller. The finishing machines have given good results. The belt and roller method has been developed and is now in more universal use than any other method. The strike-board is followed by a metal roller which is 10 inches in diameter, 6 feet long and weighs about one pound per linear inch. The roller is followed by a belt 6 inches to 10 inches wide. This method produces a tough, gritty surfaced concrete. Tests on concrete slabs treated by the belt and roller method show an increase in cross breaking strength of 20 per cent over the old style wood float finish.

The principal fact to bear in mind regarding the curing of the road is that it should be kept moist for about two weeks. This can be accomplished in many ways, using a layer of earth and sprinkling, or on level roads making small earth dams and "ponding" with water. The ponding method of curing can be used on grades which do not exceed 5 per cent.

Roads are a military and economic necessity. We realized this fact more each day during the war. The need for good roads is apparent throughout our entire country. And after all our experience of years of road building, we all know that good, durable roads have but one meaning to us and that is Portland cement concrete roads.

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Saving by Well Drilling in Quarry Operation

By F. H. Gunsolus

The writer recently visited a quarry in which crushed stone was prepared for railroad ballast exclusively. The rock was rather hard limestone, flat strata and the height of the face about 80 feet. The short bench system of drilling and tripod were used, holes being drilled from 16 feet to 20 feet deep and from 20 to 40 holes being shot at one time. Holes were usually set on an 8-ft. spacing and sprung twice before loading. Stone was loaded into the cars with a steam shovel, and the average daily output of the plant working 11 hours was 1,800 crushed yards. This was exceptionally good work for a shovel of this size.

In all, there were 15 tripod drills in operation, driven by air for bench drilling, and nine jack hammer drills for secondary preparation of the stone. Each tripod drill required two men and the average footage was about 50 feet per day. The custom was to shoot out the bottom bench, then go over the shot with the hammer drills and block hole the large pieces before shooting the second bench above. Then the second bench was shot down and it was similarly prepared before shooting the third, and so on. In this way all the stone was well broken up so that the shovel could work without interruption and load the very maximum.

The writer suggested that as the stratification and other conditions were favorable, a well drill and shooting of large blasts would be more economical. The superintendent doubted whether if he adopted a big drill he could maintain his present output. He would probably be compelled to operate two shovels instead of one because many of the large pieces could not be broken up until the shovel had run into or uncovered them and the consequent delays while jack drilling and shooting them would reduce the shovel loading capacity.

At present the steam shovel worked continuously and very rarely was it necessary to stop for any shooting ahead. There was good sound reasoning in his contention, but it was no argument against the big drill and large shooting.

The trouble was that the crusher was too small, a No. 10, and out of balance with a steam shovel.

The plant was designed for 30,000 yards per month and by good management was turning out upwards of 40,000 yards per month.

The unit cost of production, however, was extremely high, especially so the drilling cost. Thirty men were necessary to run the tripod drills, and there was a big force employed for bench cleaning and track lifting and laying. It required two blacksmiths and two helpers for dressing drill steel. It was estimated that the drilling cost was about \$200.00 per day, this including cost of labor, fuel, maintenance, etc., and the powder cost per yard was no less than if large blasts were made.

With a little start, two well drills could keep the plant supplied with stone. These would require two men each and one blacksmith and helper could take care of the steel. Besides their use would do away with bench cleaning and the maintenance of a large track gang. Probably less than nine jack hammers would be necessary for secondary preparation. The explosive cost per unit would probably not be any less, because, as a rule, no saving is made on this item in heavy shooting, but the big savings in other items are well worth trying for. After a time, the holes could be spaced to obtain as good fragmentation as at present.

It would pay well to install a larger crusher and a larger shovel, as in a short time the saving would more than balance the cost of improvements. It would be possible to reduce the drilling cost at least 100%. Besides the elimination of large labor force, and labor is a problem now at all quarries, men of any kind being hard to get and harder to hold.

Large blasts certainly mean economy in quarry operation, and where the conditions are at all favorable, the man is short-sighted, indeed, who does not see it.

Leading powder manufacturers are always willing to advise quarry operators in regard to making big blasts. They have a competent staff, familiar with the best methods, and can place at your disposal the services of their staff in solving your blasting problems.

Quarry Blasting with Electricity

A. S. Anderson*

Electric devices for blasting are of about the same convenience in using explosives as an electric starter is on an automobile. They eliminate most of the drudgery and uncertainty. The use of electricity in blasting refers to the detonation of the charge by means of electricity. A very small amount of current is necessary, and by passing it through a very sensitive electric blasting cap we are able to explode the charge from any position and at the desired time. We are also able by this means to explode a large number of adjacent charges simultaneously. This method, therefore, also eliminates most of the dangers of blasting and insures more certain and satisfactory results.

Units Used in Electrical Blasting

The detonator used is similar to an ordinary blasting cap with the exception that two wires enter through the open end, and the terminals are connected by a very fine platinum wire. This is imbedded in a loose ignition charge, similar to the pressed charge in the bottom of the copper shell. These wires are held in position by a composition plug and some melted sulphur and waterproof compound poured around them, to the end of this shell. Electric blasting caps are therefore practically air-tight and water-tight, and safer to handle than the ordinary open end blasting cap. This platinum wire has a resistance of less than 1 ohm and is therefore heated by an electrical current of about 1 ohm and 1 ampere. The heating or melting of this platinum wire ignites the charge and causes the cap to explode. It requires at least 1½ ohms and 2 amperes to melt this bridge.

Wires and Connections

Because of the small amount of current necessary, small wires can be used to carry the current from its source to the exploders and between the various charges. No. 20 insulated copper wire is usually used on the exploders and between charges. For the long distances between the source of power and the holes, larger wire is recommended, such as No. 14, to eliminate unnecessary resistance. The exploders may be connected in three ways: First, in series; second, in parallel; third, in two or more parallel series. It requires at least two amperes of current to explode the electric caps in one series, to insure instantaneous ignition of all exploders. One and one-half ohms are

*Written for Du Pont Magazine.

necessary to force this current through each exploder in this series. That is, one and one-half times the number of caps in a series will give the necessary voltage. It is safer to use twice the number of caps to get the voltage. For each exploder or series of exploders two amperes should be used when they are connected in multiple. The voltage necessary for parallel connection can be determined by dividing by the number of series the voltage found necessary to force two amperes through the series which has the greatest resistance.

Kind of Connection to Use

The series connection must always be used when a blasting machine is employed to explode the charges. The parallel, or parallel series, connection is usually used when dry cells or electrical generator is the source of the electricity for firing the blast. When multiple series connections are used the various series should be as near the same resistance as possible.

Ways of Producing Current

Current for firing the blast may be obtained from three sources, the first and most common of which is the blasting machine manufactured for that purpose. They are built to fire from one to two hundred exploders, depending upon the kind and size. They can be used only where the electric blasting caps are connected in series. That is because the amount of current produced is limited to about three amperes, while the larger machines will develop several hundred volts. When firing a charge with a blasting machine be sure that the machine is not overloaded, and test it frequently with a rheostat and exploders to make sure that it is up to capacity and in good working order. When a three-post blasting machine is used, one wire should always be connected to the middle post. When

erator may be furnishing power irregularly and not be actually delivering that power at the time the blast is made. If a line is furnishing 250 volts and 10 amperes to some lights or a motor beyond the point where the line is tapped, this can be safely short-circuited to fire 125 exploders in one series or five series of 625 exploders each. Such use of this current will not interfere with the operation of the motor or the lights, as it is used for too short a time.

Dry cells can be used for exploding electric blasting caps, but are not recommended, as their deterioration makes their strength too uncertain. An ordinary telephone dry cell should produce 25 amperes and $1\frac{1}{2}$ volts, when new. The amperage gradually decreases. One cell will heat the platinum bridge of an electrical exploder to a red or white heat, while two cells connected in series will melt it instantly. Two new cells will fire 12 exploders connected in parallel. For each additional exploder in a series it is necessary to add a cell. Smaller cells than this can be used, as their voltage is the same, but the amperage is less. Extreme caution should be observed, when using dry cells, to make certain that the connection is not made until the desired time, when everyone is at a safe distance. Make sure also that the wires are not left connected to the cells.

Precautions to Be Observed

1. Be sure that all the electric blasting caps are in first-class condition and of the same make, before inserting them in the charge. Use waterproof caps in water and submarine caps in water over 30 feet deep.
2. Be sure that each blasting cap is properly inserted into the primer cartridge and that it is securely tied so that it will not be pulled out.
3. It is best to place the primer in the charge so that the closed end of the cap points toward the center of the charge.
4. Use care in loading the holes to prevent breaking the wires or scraping off the insulation. Test frequently with the Du Pont galvanometer in loading large charges.
5. After the hole is loaded, coil up the protruding wires and cover with dry sacking or paper or dry earth to protect from abrasion and from lighting. Place an empty powder box over the loaded hole if it is to remain for any length of time.
6. Never load dynamite or exploders into a hole during a lightning and thunder storm. Refrain from loading an easily ignited explosive where sparks are flying from any source. Keep all unnecessary persons away while loading, connecting and firing blast.
7. Before connecting the holes remove all debris adjacent to them.

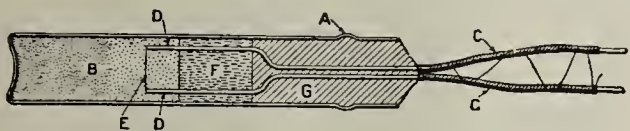
8. In connecting up the holes use care to insure proper connection, make good, tight electrical joints, cut out extra wire, and do not hurry the work, but take time to do it properly.

9. If the ground is damp either raise the joints or tape them well, to prevent short circuits or grounds.

10. The leading wires used from the source of power to the end holes should be a well insulated copper wire about 14 gauge or equivalent to that. Try to place these so that they will not be injured by the blast and they can be used a great many times.

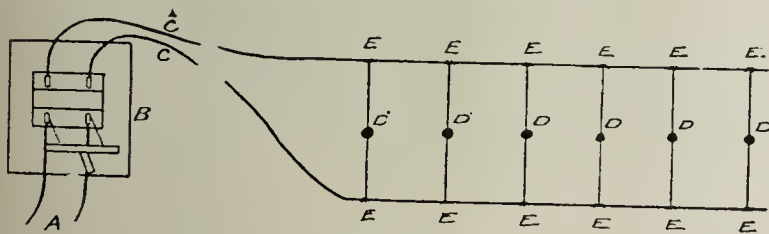
11. Test each circuit with the Du Pont galvanometer to make sure that it has approximately the correct resistance as shown in the table of resistances furnished with this instrument.

12. Test the source of power with the Du Pont rheostat, using two exploders connected in series as indicators, to make sure that enough current will be furnished for the blast.



An Electric Blasting Cap in Section

"A" is a copper shell having a corrugation thrown out from the inside, which holds the composition plug more firmly in place. "B" is a chamber containing the explosive charge. "C," insulated copper wires entering the cap. "D," the bare ends of the copper wires, projecting through the plug into the charge. "E," a fine wire "bridge" soldered to and connecting the two ends of the copper wires, which is heated by the electric current, thereby firing the explosive charge. "F," the composition plug holding the electric blasting cap wires firmly in place. "G," the filling material.



Parallel Connections



Series Connection

three wires are used the wire from the middle post should be connected to the middle of the series. Thus the resistance on both sides will be equal.

When a lighting or power circuit is convenient, it can be used to fire blasts. One must be sure, however, that the amount of current and voltage necessary to fire the blast is actually being delivered at the desired point and at the exact time the blast is made. It is not sufficient merely to tap a line which can deliver a certain voltage and amperage. For instance, the gen-

13. If a blasting machine is to be used be sure that all the exploders are connected in one series and that the number is not beyond its actual working capacity.

14. In operating the blasting machine do so with full force to insure the development of its capacity current. Always operate the machine two or three times before making the blast to be sure that it is working smoothly and to develop a little residual magnetism in the field coils.

15. When blasting from a power circuit, it is best to have a two-blade switch which can be thrown in for a few seconds and then pulled out. Count to five or ten while the switch is in. Place this switch so that gravity will cause it to stay open. This switch should be in a lock box so that the switch can be locked open, with the keys in the possession of the blaster.

16. When using dry cells, they should be in a lock box or in the possession of the blaster, who can personally make sure that the wires are not touching the cells.

17. When a three-post blasting machine is used, be sure to connect one wire to the center post when two wires are used. When three wires are used, connect center post to middle of series and do not make connection directly over a hole.

18. For detailed information on supplies for electrical blasting consult the Du Pont Blasting Supplies Catalogue.

New Gyratory Crushers with Improvements

Improvements rather than radical departures from general practice mark the new line of gyratory crushers of the Traylor Engineering & Manufacturing Co., Allentown, Pa. The particular features of the new crushers are referred to by number in the accompanying sketch.

The main shaft, which is of extra diameter throughout and of hammered steel, is suspended in the spider at the point of no motion by means of an all-steel suspension. This consists of a nut (5), which is screwed on the end of the shaft (22) and is held in position by a steel key (4). This nut rests on a steel sleeve (6), which in turn rests on a steel wearing ring (8) supported in the spider hub. The suspension ring or sleeve (6) comes in contact with a bushing (7), which is fitted in the spider (2) so as to take the wear.

The shaft (22) may be readily raised or lowered by means of the adjusting nut (5), thus decreasing or increasing the opening between the head and concaves to produce the size stone desired.

The crushing head is held to the main shaft, which is tapered to receive it and is held in position by means of nut (14) that is screwed to the shaft above the head, so as to prevent the head from moving upward. There is a second nut (13) placed over this nut (14), so as to securely lock same in place, thereby eliminating any possible movement.

For harder grades of rock the manufacturers recommend the use of manganese steel. In the large machines the manganese steel part of the head consists of a mantle which is placed over a semi-steel center. The heads, either manganese or steel or chilled iron, are corrugated or smooth.

The crushers are fitted with concaves of either chilled iron or manganese steel, depending upon the material being crushed. The crushers are also fitted with combination concaves of chilled iron on the upper section and manganese steel in the lower section where the greatest wear comes.

The bottom shell is a casting, heavily ribbed, with an opening in the center through which the main shaft

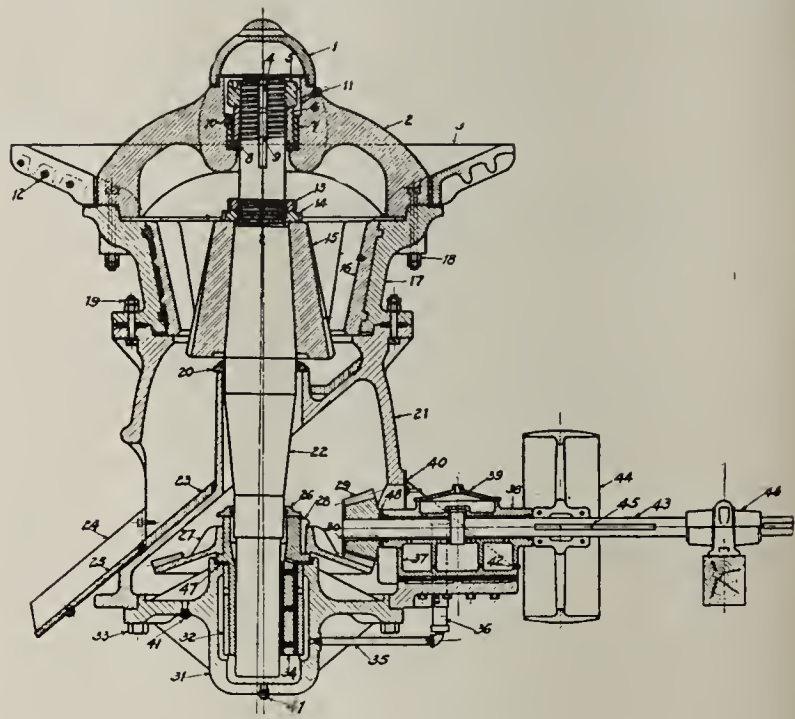
operates. The lower shell is lined with chilled iron-wearing plates (23) on the discharge chute. This slopes at a sharp angle downward and through it the material is discharged to the elevator or bin. These liner plates (23) are made so that they project part way up the side of the lower shell to prevent wearing the shell at this point.

The bevel gear (27) and pinion (29) are made of high carbon cast steel. The gear is detachable, being securely held to the eccentric sleeve with a gib head.

The eccentric is of large proportion, reducing the pressure per square inch. The upper part of the eccentric is machined for receiving the steel gear (27). The lower part is babbitted. The babbitt in the eccentric (34) is equal in height on both the inside and outside of it; the height of the babbitt on the outside is the oil level. This design allows of positive lubrication of the complete eccentric bearing.

Around the eccentric (34) are pockets for receiving the lubricant, which is forced into the bottom of the eccentric cavity and out at the top by means of a positive force feed lubricator. It has been found by experience that a heavy type of lubricant gives the greatest efficiency. Dust and dirt are kept out of the eccentric (34) by being continually forced out through the top of the eccentric and away from the bearing surfaces. The weight of the gear (27) and eccentric (34) is carried on a bronze wearing ring (47) which fits into the bottom plate (31).

The bottom plate (31) which supports the eccentric (34) is a casting, heavily ribbed and securely bolted to



the lower shell (21). It has openings cored in it which act as pockets for the lubricant and completely encircle the eccentric bearing. It is fitted with a removable bushing (32), which prevents any wear taking place on the bottom plate.

The crusher is fitted with a removable countershaft bearing of heavy design. This bearing is furnished with liners by means of which it can be raised or lowered to take care of any wear on the gear and pinion, with the result that they always have their teeth in full mesh; therefore their maximum life is assured. It is also fitted with an oil reservoir, which lubricates the bearing by means of a collar fitted to the countershaft.

The countershaft operates in the countershaft bearing (37) and on the inner end is securely keyed the cast steel bevel pinion (29); the outer end is supported by the outboard bearing (46).

The Lime Industry in 1918

General Conditions.

About 3,028,000 short tons of lime was made and sold in 1918 in the United States, including Porto Rico and Hawaii, the lowest recorded production since 1908 and a decrease of 20 per cent from that of 1917, which represented a decrease of 7 per cent from the record output, that of 1916 (4,073,433 short tons). The estimate of the output in 1918 is based on returns made by the principal producers to G. F. Loughlin, of the United States Geological Survey, Department of the Interior. Of the 41 producing States and Territories only South Dakota, New Mexico—both very small producers—and Tennessee, reported increased sales. The increase in Tennessee—17 per cent—is in striking contrast to the decrease in all other States that reported considerable production. The percentage of decrease varied within wide limits; Michigan lost only 2 per cent and Indiana 3 per cent, whereas California lost 37 per cent, Wisconsin 38 per cent, and West Virginia 45 per cent. Even greater decreases were reported from some of the States that made only small production; Florida lost 54 per cent, Oregon 55 per cent, Idaho 76 per cent, and Rhode Island 96 per cent. All producers reported that prices in 1918 were 10 to 35 per cent higher than in 1917, and the total value may, therefore, not show marked change.

The following table shows the estimated output of all States that marketed more than 30,000 tons of lime in 1918. All these States produced more than 50,000 tons in 1917.

Estimated Production of Lime in the United States in 1918.

	Total lime		Hydrated lime	
	Quantity (short tons).	Percentage of change from 1917.	Quantity (short tons).	Percentage of change from 1917.
Pennsylvania	800,000	-14	145,000	+ 2
Ohio	350,570	-27	225,750	-29
Virginia	255,880	-18	11,310	+52
Missouri	199,850	-15	32,250	+ 4
West Virginia	134,270	-45	41,350	-20
Michigan	133,410	- 2	(a)	- 1
Tennessee	118,800	+17	16,970	- 9
Massachusetts	117,840	-13	(a)	-21
Indiana	115,300	- 3	24,490	+12
Maryland	113,110	-15	27,610	+34
Wisconsin	105,260	-38	18,200	b+
New York	93,470	- 4	8,880	+ 4
Maine	88,670	-30	(a)	-10
Illinois	64,670	-22	(a)	-30
Connecticut	(a)	-17	(a)	+36
Alabama	49,730	-25	6,430	- 2
California	48,930	-37	3,230	- 8
Texas	44,710	-15	15,480	+10
Vermont	31,820	-31	(a)	-42
Undistributed	161,600	....	50,000	....
Approximate total.	3,028,000	....	627,000	....

a Included in "Undistributed."

b Sales not disclosed in 1917.

The sales of hydrated lime in 1918 amounted to about 627,000 short tons, a decrease of 11 per cent from the quantity reported in 1917 (709,757 short tons), which in turn was a decrease of 1.6 per cent from the

record production of 1916 (717,382 short tons). Of the principal producing States eight showed increases in sales ranging from 2 per cent in Pennsylvania to 34 per cent in Maryland and 52 per cent in Virginia. The output of ordinary quicklime, including some dead-burned high-magnesium lime for refractories, decreased nearly 22 per cent, from 3,072,207 short tons in 1917 to 2,401,000 short tons in 1918, a decline which indicates that in spite of the adverse conditions hydrated lime held its position far better than quicklime.

Building Lime.

War restrictions on the building trades greatly reduced the demand for building lime, the production of which in 1917 amounted to one-third of the total lime output. Manufacturers of building lime, except those who supplied Government contractors, reported decreases in demand ranging from 5 to 90 per cent in 1918, and some plants that supply only building lime were closed throughout the year. A number of Government building projects, most of them in the East, had called for or were likely to call for lime during the last two months of the year, but some of these projects may have been abandoned after the armistice was signed on November 11. All restrictions placed by the War Industries Board on the production and transportation of lime were removed on November 12, too late to have any appreciable effect on the recovery of the industry before the end of the year. In view of these conditions it will not be surprising if the revised and itemized figures show that the building lime sold in 1918 has fallen to about 900,000 short tons and that building lime has for the first time lost to chemical lime its lead among the lime products.

The general curtailment of building operations since the spring of 1917, however, implies that greatly increased activity is necessary to restore the country to normal conditions in this respect, and the Federal Government is already taking steps to stimulate building. Doubtless many prospective builders are inclined to wait for a decrease in costs, but although the cost of some necessary commodities and of labor may decrease slightly, the great demand for buildings will probably maintain the prices of building materials in general at a high level.

Chemical Lime.

Sales of chemical lime, stimulated since 1914 by war needs, continued to increase. Most manufacturers reported the demand to be from 2 to 70 per cent greater than in 1917, and only a few reported a decreased demand. The output was curtailed, however, by shortage of labor, fuel, and transportation facilities. From 1908 to the early part of 1914 the sales of chemical lime had been increasing steadily and on the whole uniformly. This normal rate, however, was much more gradual than the rate from 1914 to 1918, and the return to normal conditions in 1919 may therefore be accompanied by decreased sales of chemical lime. Continuation of the normal rate of increase would indicate sales of less than 700,000 tons in 1919.

Agricultural Lime.

Producers of agricultural lime were about equally divided in reporting the demand as good, poor, or practically unchanged. In some regions the good demand could not be supplied, owing to shortage of labor and fuel. High cost of production caused many kilns that

are operated on a small scale for local farm use to be closed. The high prices prevailing for all kinds of lime probably reacted more against agricultural lime than against any other kind, especially in curtailing purchases by farmers with small capital. Government restrictions also tended to discourage production. Early in 1918 there was great difficulty in obtaining cars, but in March the Railroad Administration agreed to give agricultural lime and pulverized limestone preferred classification for 60 days. On August 1 an order was issued by the War Industries Board requiring farmers to procure a certificate if they required more than 1 ton (enough for 2 acres) of agricultural lime a year. They were relieved of this restriction, however, on October 19, when the State experiment stations were delegated to supervise the distribution of lime. All restrictions were removed on November 12. The quantity of agricultural lime sold annually has been declining at an increasing rate since 1914, and the sales of pulverized limestone, with which it competes, have also declined since 1916. There is a growing conviction, however, that lime in one of these forms is essential to agriculture, and an increase in sales of both products is to be expected in 1919. The degree of increase will depend on the degree of relief from shortage of fuel and particularly of labor.

Other Lime.

The demand for lime by other than the building, chemical, and agricultural industries was reported by 13 producers as poorer than in 1917, by 9 as about the same, and by 4 as better. Decreased demand by paper mills were noted. The quantity sold annually to paper mills, after increasing slightly from 1909 to 1912, decreased markedly until 1915. In 1916, owing probably to a greater demand for domestic wood pulp, sales of lime to paper mills increased rapidly and reached record figures, which were exceeded by a small margin in 1917. In 1918, however, the paper industry was impeded by a shortage of necessary supplies, which evidently accounts for the decreased demand for lime. The demand in 1919 by the paper industry may be favored by relief from the war shortage of materials, but it may be lessened by restoration of imports of wood pulp to a pre-war basis. These conflicting conditions and the varying demand prior to 1916 render a forecast of the demand in 1919 of little value.

Sales of lime and of limestone to sugar factories have fluctuated annually since 1910, and a decrease in 1918 after an increase in 1917 adheres to this rule, which, however, is no indication of the status of the sugar industry, but rather an indication that sugar companies, particularly in California, lay in a surplus of lime or limestone on an average every other year. The high prices prevailing in 1918 would naturally have discouraged the maintenance of a surplus, and continued high prices may result in the purchase of only the quantity immediately needed in 1919.

Conditions in Commercial Districts.

In previous reports brief reviews of the lime situation have been made according to ordinarily recognized State groups, such as New England and the Pacific Coast States. In this report the reviews are presented according to the commercial districts established in 1918 by the Lime Association, which represents a great majority of the lime producers, and the War Service Committee on Lime. The boundaries of these commercial districts agree closely with those of the groups formerly considered, and the few differences will be explained in the following paragraphs.

Estimated Production of Lime in 1918, by Districts

DISTRICT.	Quicklime.	Hydrated.	Total, 1918.	Total, 1917.
1	277,450	36,910	314,360	394,589
2	70,410	(a)	70,410	85,872
3	551,640	152,610	704,250	816,929
4	284,920	61,350	346,270	502,838
5 <i>b</i>	244,570	11,310	255,880	307,195
6	124,820	225,750	350,570	479,856
7	133,410	(a)	133,410	135,920
8	323,080	<i>c</i> 56,740	379,820	436,875
9	115,320	<i>c</i> 18,200	133,520	206,859
10	102,330	16,970	119,300	102,559
11 <i>d</i>	43,300	6,430	49,730	66,744
12	15,700	.....	15,700	27,082
13 <i>e</i>	29,230	15,480	44,710	52,742
14	81,810	10,890	92,700	144,976
Undistributed ...	17,250	.....	17,250	25,328

Approximate

total..... 2,401,000 627,000 3,028,000 3,786,364

a Included with quicklime.

b Virginia only; North Carolina included in "Undistributed."

c Hydrated for Illinois and South Dakota included in quicklime.

d Alabama only; Florida included in "Undistributed."

e Texas only; New Mexico included in "Undistributed."

The output of district No. 1, including the New England States and the narrow area east of Hudson River in New York, was estimated at 314,360 short tons, of which 36,910 tons was hydrated lime. These figures represent a decrease of 20 per cent in the total sales of the district, a gain of 6.7 per cent for hydrated lime, and a decrease of more than 23 per cent for quicklime. All producers reported increases in prices—some as great as 50 per cent—and greatly increased costs of production. Two producers reported the demand for building lime to be the same as in 1917, but all other producers report a greatly reduced demand—from 45 to 65 per cent less than in 1917—in fact, three producers reported no sales at all for this purpose in 1918. The demand for chemical lime increased from 20 to 70 per cent and in large part made up for the decrease in building lime. One company, however, reported the demand as only fair, and another reported it as 25 per cent less than in 1917. A large proportion of the chemical lime sold in this district is used in the manufacture of paper, and the demand for this use was reported as somewhat decreased in 1918. The demand for lime for agriculture was more varied. In Maine it was reported better, the same, and not as good as in 1917; in Massachusetts and Connecticut the demand as reported ranged from 20 per cent less to 500 per cent more than in 1917; in Vermont and New York it was about the same as in 1917. There appeared to be no demand for lime for any other purposes than those mentioned. Scarcity and cost of fuel, Government restrictions, and lack of labor were reported.

The second district includes all of New York west of Hudson River. The output of the recently built plant of the Kelley Island Lime & Transport Co., at Buffalo, N. Y., which burns stone brought from the Ohio quarries of this company, is credited to this district. The total output of lime in this district in 1918 was 70,410 short tons, or 15,462 tons (18 per cent) less than in 1917. The output of hydrated lime decreased 43 per cent. At Niagara Falls a considerable amount of lime is manufactured from stone quarried in Michigan, but as this stone is purchased by the manufacturer and re-

ported by the quarrying company, it is recorded in the Survey's report on stone. The lime burned by the Solvay Process Co. for the manufacture of alkali is also not included. Conditions in the building-lime trade were reported as poor. The demand for chemical lime was good, and that for agricultural lime the same or better than in 1917. Two of the plants operating in 1917 were closed in 1918.

The estimated output of the third district, which includes eastern Pennsylvania, New Jersey, and Maryland, amounted to 704,250 short tons, of which 551,640 tons was quicklime and 152,610 tons hydrated lime, a decrease in the total of about 13 per cent and in quicklime of 18 per cent, but an increase for hydrated lime of about 4 per cent. Eastern Pennsylvania produced 125,000 tons of hydrated lime, and Maryland 27,610 tons, both showing increase over the output in 1917, on account of war conditions. In one region, however, the demand was 5 per cent above that of 1917, and at two different plants in Maryland it was reported as good. Demand for chemical lime in both States was reported by most producers to be from 21 to 50 per cent greater, although a decrease in demand was noted in places. The demand for agricultural lime, which is one of the principal lime products of this district, appeared to be very good in spite of high prices, although in some places it could not be met, owing to shortage of labor, fuel, and cars and to freight embargoes. Decreased demand was also reported by some producers, and several comparatively large plants, as well as many small kilns operated for local use, were closed throughout the year. The demand for lime for other purposes, including dead-burned lime for refractory use, was reported as about the same as in 1917.

The sales of lime in 1918 in the fourth district, comprising western Pennsylvania and West Virginia, were estimated at 346,270 short tons, a decrease of 30 per cent from the sales in 1917. A small part of the decrease was accounted for by the war restrictions on the building trades but the demand for chemical and agricultural lime was good. Lack of labor, felt more in this district than in any other, high freight rates, embargoes, and high prices to meet increased cost were the main causes of the curtailed output. The hydrated lime produced amounted to 61,350 tons, a decrease of over 18 per cent. The total estimated output of lime in West Virginia decreased 45 per cent; that of western Pennsylvania decreased only 17 per cent.

The estimated production of lime in the fifth district, which includes Virginia, North Carolina, and South Carolina, amounted to over 260,000 tons, which was about 15 per cent less than in 1917. The production of hydrated lime, which comes entirely from Virginia, was estimated at 11,310 tons, an increase of 52 per cent, although the total output of lime in Virginia, 255,880 tons, showed a decrease of 18 per cent. Only one company operated in North Carolina, and none in South Carolina. The demand for building lime was reported as 25 to 75 per cent less than in 1917. Chemical lime for Government contracts was in good demand, and any decrease in output was due to lack of labor. Decreased sales of agricultural lime were reported by one or two producers, although the general demand was fairly good; but lack of fuel and labor was felt by all producers.

The estimated production of lime in Ohio, which constitutes the sixth lime district, amounted in 1918 to 350,570 short tons, 27 per cent less than the production in 1917. Hydrated lime, the estimated output of which was 225,750 short tons, decreased 29 per cent, and quicklime, which constitutes about two-thirds of the Ohio lime production, suffered the most under the war restrictions,

the considerable decrease in the total output of the state needs little comment. The producers reported small demand for this product except for Government work, and the demand fell off 30 to 80 per cent. The demand for chemical lime was about the same or slightly better than in 1917. Some of the producers of agricultural lime reported poor demand, but several reported better conditions of trade than in 1917. The figures for this district do not include limestone sold for burning to lime manufacturers in other states.

The estimated quantity of lime burned in 1918 in the seventh district, the state of Michigan, was 133,410 short tons, which was but 2 per cent less than in 1917. The demand for building lime in this district was practically negligible in 1918, the output consisting almost entirely of chemical lime, of which a large part is used in the manufacture of calcium carbide. Limestone from Presque Isle county, Mich., is shipped to Buffalo, N. Y., and manufactured into lime near that place, but this production is not included in the output of Michigan. Hydrated lime is made by two operators in this state, and the estimated production for 1918 was practically the same as for 1917.

The eighth district, which comprises Illinois, Indiana and Missouri, was the second district in rank of production. The output as estimated for 1918 was 379,820 short tons, a decrease of 13 per cent. The estimated output of hydrated lime was over 64,000 short tons, or more than 4 per cent less than in 1917, and that of quicklime was nearly 323,080 tons, a decrease of about 13 per cent. Missouri's production, which represents over 50 per cent of this district's total, was estimated at 199,850 short tons, a decrease of 15 per cent. There was a slight increase in this state for hydrated lime, but quicklime showed a decrease of 17 per cent. The estimated production of hydrated lime in Indiana in 1918 showed an increase of 12 per cent, but the total output of lime for the state decreased 3 per cent. Illinois, over one-half of whose output of lime is used for building, showed a decrease of 22 per cent in total production and of 30 per cent in hydrated lime. Throughout this district the demand for building lime was reported as very poor, one producer putting it at 75 per cent less than in 1917, although three companies reported it the same as in 1917. Chemical lime (including lime for paper mills) was reported as in better demand than in 1917, except by two companies, whose sales were about the same as in the previous year. The demand for lime for steel plants was reported as good, and little change was noted in the demand for lime for other uses. At Logansport, Ind., a lime plant was put into operation by the Logansport Lime & Stone Co. and at Salem the Louisville Lime & Cement Co. was succeeded by the Hoosier Lime Co. In Missouri the Bluff City Lime & Cement Co. started operations at the quarry of the Star Lime Co. at Hannibal, which had not been in operation for some time. Several plants in the district were idle in 1918. One plant in Illinois that was idle in 1917 resumed operations.

District No. 9, including Iowa, Minnesota, Montana, South Dakota and Wisconsin, decreased 35 per cent in output, from 206,859 tons in 1917 to about 133,520 tons in 1918. Wisconsin's output represented over 78 per cent of the total, and as this state furnishes building lime almost entirely, the greater part of the decrease in the district is accounted for by the war restrictions upon sales of building material. Minnesota's output is also sold principally for use in building. In Wisconsin the demand for building lime was reported as less by 15 to 80 per cent than in 1917. In Minnesota and Montana the demand was reported as 50 per cent less, and in South Dakota this trade was very slack. In Iowa, however, the demand was reported as greater

than in 1917. Although comparatively little chemical lime is usually sold in this district, the demand was reported as very good, especially that for lime to be used in paper mills and tanneries. Prices were reported as much as 25 per cent higher than in 1917. The output of hydrated lime, manufactured principally in Wisconsin, amounted to more than 18,500 tons, a considerable gain over 1917. A small part of this quantity was manufactured in South Dakota. A quantity of lime is burned yearly at Duluth, Minn., from stone purchased in Ohio, but this is not included in the figures of this report.

The tenth district includes Tennessee and Kentucky, but Kentucky produces only a small quantity of lime for local use. The estimated output of this district in 1918 was 119,300 short tons, which was an increase of 16 per cent. This district was the only one to show an increase of output in 1918. The production of hydrated lime decreased from 18,594 tons to 16,975 tons, nearly 9 per cent, and was reported by the same companies as in 1917. The plants of the Wheeler Lime Manufacturing Co., near Nashville; the Interstate Lime Corporation, at Bristol, and the Clinchfield Portland Cement Corporation, at Kingsport, were new operations in this district in 1918. Other than for Government work there was little call for building lime. The demand for chemical lime in this district was reported as very good, especially for use in powder plants. The demand by sugar factories was reported as less in 1918 than in 1917. Prices of all kinds of lime were reported from 10 to 35 per cent higher than in 1917.

The eleventh district includes Georgia, Alabama and Florida, but for several years no lime has been manufactured in Georgia other than for local use. The estimates furnished by the Alabama producers for 1918 have not been as complete as could be desired, but from the data in hand the output of the district is estimated at 54,290 short tons, a decrease of 30 per cent. The output of hydrated lime, amounting to over 8,000 tons, also decreased, although one new hydrated lime plant was reported. In Florida one plant was idle and another reported operating for only a few months. Difficulty was experienced in carrying on operations owing to shortage of labor, cars and fuel. Lime for building was reported as in good demand only by firms that furnished it for Government contracts. The sales of chemical lime were reported to be as good as in 1917, or better, and the output of agricultural lime was restricted by shortage of labor rather than by demand. Prices of all grades of lime were 25 per cent or more higher than in 1917, and operating expenses increased in proportion.

The twelfth district, which comprises Arkansas, Colorado, Kansas, Nebraska, Oklahoma and Wyoming, had an estimated production of lime in 1918 of 15,700 tons, a decrease of over 40 per cent. All the states in the district showed decreases in production. Arkansas, whose output is practically all building lime, had a decrease of more than 50 per cent. No lime is manufactured in Nebraska, and but little other than for local use in either Kansas or Wyoming. No hydrated lime is manufactured in any of these states. The general poor demand was reported for building lime, but chemical lime and agricultural lime were in about as good or better demand than in 1917.

The thirteenth district, including Texas and New Mexico, reported sales of more than 46,000 tons of lime in 1918, a decrease of 14 per cent from the sales in 1917. Nearly all of this lime is manufactured in Texas, whose estimated output decreased 15 per cent, while that of New Mexico increased about 14 per cent.

Most of the Texas lime is sold as building lime. The demand seemed to vary in different places, as of the five companies commenting on this class of lime, three reported large decreases—one of 80 per cent—whereas one company said that the demand was favorable during the first half of the year and very light during the last few months, and the fifth company reported the same demand as in 1917. The largest producing company in New Mexico reported about the same demand for building lime as in 1917. Large quantities of lime for the treatment of water were sold in New Mexico. The demand for chemical lime was variously reported as increased, as about the same as in 1917, and as very much less. Prices were reported as high by all producers. The 15,480 short tons of hydrated lime reported by three firms in Texas showed an increase of nearly 10 per cent over 1917.

The fourteenth district, which includes Arizona, California, Idaho, Nevada, Oregon, Utah and Washington, produced 92,700 short tons of lime in 1918, 36 per cent less than the total for 1917, which was 144,976 short tons. California's output, which represents over one-half of the district's total, was 48,930 tons in 1918, a decrease of 37 per cent. Washington's estimated output of 15,570 tons represents a loss of 23 per cent, and Arizona's estimated output of 10,900 tons a decrease of 31 per cent. All the other states in the district showed decreases in output. Washington, California, Arizona and Idaho gave an estimated production of 10,890 tons of hydrated lime, a decrease of but 2 per cent. The small demand for building lime due to war restrictions on the building trade was felt in this district, as in all others. Much less lime was burned by and for the sugar factories than in 1917. In Arizona, Idaho, Nevada, Washington and in some parts of California the demand for chemical lime was reported as less than in 1917, but three companies in California reported it as better. The demand for agricultural lime was said to be poor by the producers, except one in California, who reported sales of twice as much as in 1917. The demand for other kinds of lime in this district was reported as about the same as in 1917.

Jeffrey Pivoted Bucket Conveyor

The Jeffrey Manufacturing Company, Columbus, O., have issued a new catalog No. 210 on the Jeffrey Improved Carrier, their latest type of Pivoted Bucket Conveyor for the handling of coal, ashes, clinker, etc.

The Jeffrey Improved Carrier was conceived about three years ago out of nearly twenty years of experience in the installation of successful Pivoted Bucket Equipments, and was designed to embody from every angle the complete sense of the words Reliability and Long Service; reliability in its action at all times, whether the installation outline be intricate, the surrounding conditions crude, or the attendant labor not of a high class; coupled with a maximum of material strength and hardness of wearing surface which means for long service. The carrier is proving its worth in a most reliable and durable service in a large number of plants.

The new catalog is divided equally in its 96 pages between convincing and keenly illustrated details of the carrier, many interesting exterior and interior pages of large power plant equipments and also reproductions of dimensioned blue prints in actual color of typical views for the various sizes of carrier equipment, which will be of especial interest to the architect and engineer as it enables them to incorporate the Jeffrey Carrier into their building plans before placing their order for the equipment.



Screening, Crushing and Conveying Plant of the Boston Sand & Gravel Co. Two 14-Inch Belt Conveyors and One 24-Inch Conveyor, Running in a Gallery Extending Toward the Water Front, Carry the Various Sized Aggregates to Their Storage Piles.

Electrically Operated Sand and Gravel Plant

One of the principal producers of sand and gravel in New England is the Boston Sand and Gravel Company, whose main office is located at 88 Broad street, Boston. The plant is located in the vicinity of the Cliffs at Scituate, Mass., about 20 miles south of Boston. Here a hill containing a deposit of about 75,000,000 cu. yds. of excellent glacial sand and gravel in about equal proportions is being developed and electrically operated machinery is being used to excavate and convey the materials to the water side, where they are loaded directly onto steam lifters and conveyed to Boston and other points.

The location of the deposit and the method of handling are both unusual. A movable digger house, with heavily reinforced concrete floor, is located on the cliff and is equipped with a 165-h. p. motored excavating hoist, which operates a 3-cu. yd. bucket. The latter is raised and lowered by a 37-h. p. motored hoist, which tautens and slackens the 1½-in. track cables on which the bucket hangs.

Materials are emptied at the bottom of the crosswise cut in the hill, onto a timber tunnel about 150 ft. long, in which industrial cars operate on tracks which continue up an inclined trestle about 300 ft. to the tower in which is located the screening and crushing plant. Here are also located the 75-h. p. motors and the drum which draw one car up the incline while the other returns to the tunnel. Each car holds 10 yds. and has an automatic side-dumping arrangement which releases when the car comes to its berth. At the same time, a man in charge of loading in the tunnel opens the gate overhead and the materials fall by gravity into the car. A bell system connects the loader with the man in the tower.

From the hopper, the materials are chuted to a grizzly screen which has a run-off to two Symons disc crushers operated by a 75-h. p. motor which runs also a set of shaking screens, an elevator bucket conveyor and a sand conveyor. A rotary pump with a capacity of 2,200 gals. per min., driven by a 75-h. p. motor, throws sea water onto the screens, thoroughly washing the gravel. The bucket conveyor carries the

stones that have been crushed from the crusher back to the shaking screen, where they are again washed.

Two 14-in. belt conveyors and one 24-in. conveyor, running in a gallery extending toward the water front, carry the various sized aggregates to their proper storage piles. The conveyors are each driven by a 5-h. p. motor. Sand that has fallen through the screens is removed from a tank below by paddles operated by the same 75-h. p. motor which runs the crusher. The water that has passed through the screen to the tanks is carried off 500 ft. to the river meadows by a metal trough. The thorough system of washing insures absolute cleanliness to all materials.

Underneath the stone and sand piles, which are at ground level and are separated into bins by plank walls, are two parallel concrete tunnels about 8 by 8 ft. and 30 ft. apart. There are 32 gates in each tunnel ceiling, through which the materials fall onto the belt conveyors, each of which is run by a 35-h. p. motor. The conveyors run up an incline to a tower over the wharf and discharge direct to the holds of lighters moored alongside. With both belts running, a 500-ton lighter can be loaded in 30 minutes. The arrangement of gates in line in the tunnel enables the aggregates to be mixed in varying sizes as may be desired.

The gravel company operates six steam lighters, one of 1,000 tons capacity and the rest of 400 tons to 600 tons each, and also several barges. The plant has a capacity of 6,000 cu. yds. per day and is operated the year 'round. The average consumption of electricity is 40,000 kilowatt hours per month, the energy being obtained from the Abington & Rockland Co. over a 13,000-volt transmission line. In all, 560 h. p. in motors are connected. It requires 10 men to operate the plant.

New U. S. Labor Division

The creation of a new division of the department of labor to assist both capital and labor during the reconstruction period was announced recently by Frank J. Pollay, special agent of the department of labor, who made an address at the convention of the Sand and Gravel Producers at the Hotel LaSalle, Chicago.

The Engineer in Road Work

By Rodman Wiley

Commissioner of Public Roads of Kentucky.

When one speaks of an engineer he does not necessarily mean a college graduate. Of course, it is very desirable to be a graduate from a recognized school of engineering, as that forms the basis upon which to build with experience. Neither do we mean that a man is an engineer simply because he is qualified to run a transit or level or has had a few years' experience with some engineering corps. Such an idea, either in the mind of the man himself or the people in general, is an injustice to the engineering profession.

It makes no difference what branch of engineering a man may decide to follow, he will find that it takes a great deal of study, years of training and experience and plenty of common sense before he knows the A B C of engineering. In addition, he must know how to meet and deal with the public and how to handle men. He must possess more ready information than most any class of professional men.

One of the best definitions of engineering, according to my judgment, is "science applied with common sense."

One of the most prominent engineers in this country has said that a man to be a successful engineer must have 75 per cent common sense, 15 per cent chance to display it and 10 per cent education. After all, a man to be successful in most any line of work must have a good stock of common sense.

It is pertinent at this time that you should better understand the aims of the engineers engaged in road work. Some of you might think that on occasions they are arbitrary, dictatorial and altogether undesirable persons, who try to say to the various fiscal courts what they should and should not do, but such is not the case. They are laboring for your interests; they are anxious to see every administration a success regardless of what political power may be in control; they are your servants, not your masters, and they realize that in its final analysis the people are their clients.

It is, of course, but natural that engineers should at times differ from the members of the court, but that is not revolutionary. Honest men differ. A father may differ from his son, brothers often differ, and tonight, even while I speak, noted generals, each willing to give his life for his country, may differ as to the best method of attack on the morrow; but they are friendly differences, each is contending for what he considers the best, and, as a general proposition, in the end the man with the most training and experience will rule.

I trust, therefore, you will feel that the engineers engaged in road work are your friends, and on that assumption let us view the subject and see if the engineer has any place in such a great work.

In the financial end engineers are oftentimes called upon to make an examination of the road needs of a community, the possible resources, and to report to the constituted authorities the amount of money needed and the best method of securing it; at other times they advise with the proper authorities to see if their program is sound from a financial standpoint, just the same as engineers are called upon to report to bankers and brokers on the soundness of investments in other lines of work. Today very few investments of any size are made unless the proposition has the approval of some well-known engineer in whom the investors have implicit confidence.

Everyone within the sound of my voice has seen on numerous occasions the mistakes that have been made by

viewers in locating roads. It must be remembered that wherever a road is built, schoolhouses, residences, churches and business houses will follow the development. In case the location is bad it is most difficult, and oftentimes impossible, to provide any remedy, because if the location is changed all the improvements are lost, consequently the taxpayers are compelled from year to year to pay a heavy cost for maintaining an improperly located road. On the other hand, very few of you have ever seen a road located by good engineers that ever needed to be changed. France, Belgium, England and Italy realized centuries ago that whenever any road improvement was started it should be in charge of the most competent engineers in the nation, consequently the roads in those countries have been located with such foresight, such knowledge of the development of the country that it is almost impossible even at this time, with all our advanced ideas and new methods of travel, to make any desirable changes. Right in our own State when we speak today of the old L. & N. pike there is foremost in every man's mind the thought that the road is located properly, and any suggested changes are viewed with suspicion. It has stood the test of public criticism as well as the elements of destruction, and the expense for maintenance has at all times been a minimum.

The great trouble has been principally the fault of the taxpayers. They have not called for a businesslike administration of the road affairs of their counties, and, consequently, they have not received it. A road is simply one of the systems of transportation, and its location requires as much, if not more, skill on the part of an engineer as the location of a railroad, because a railroad company usually has ruling grades, ruling degrees of curvature, and no departure is allowed from those standards, whereas when locating a road an engineer must have a vision. In his mind's eye he must see the country as it will grow and as it will be years after the road is built. Consideration must be given to the finances of the county, which is usually not the case in railroad work. A railroad company might expend thousands of dollars to reduce a grade $\frac{1}{2}$ per cent, to reduce the degree of a curve one or two points, but in road work an engineer adopts such grades as will insure the economical construction of the highway, provided, of course, that traffic will not be impeded. Highway location calls for rare judgment on the part of an engineer.

The grading of a road requires the same amount of skill and experience on the part of the man doing the work as does the grading of any railroad or interurban line. The same kind of machinery, the same instruments are used for both classes of work. A railroad company never considers for one moment starting any construction work without having experienced engineers on the ground at all times to see that it is properly done; a contractor doing the work knows from bitter experience that he cannot hope to make money unless he has an experienced man in charge, and I cannot understand how men entrusted to build roads can figure that they can depart from the usual custom or that they can break all precedents and do something that railroad companies and contractors have found to be impossible from an economical standpoint and impracticable from all other angles.

When it comes to surfacing any road, the man in charge should have a thorough knowledge of the behavior of all local materials under different kinds of traffic and different climatic conditions, as well as to understand the method of doing the work. Experience has shown that

*Address before Kentucky Highway Engineers' Association.

attention to minute details is necessary if any type of road is properly built. All of you have seen roads built of stone, and you know that one man can take a certain amount of stone and build a good road and another man will take the same class of stone and the same amount of stone and build an inferior road. That shows for itself that there is something in a man knowing how. However, the most important thing about the surfacing of any road is knowing the type to select. A great many men have had sufficient experience to know how to build a gravel road, a macadam road or most any type of road that might be selected, but the real engineering comes when we are trying to decide the proper type to build in certain localities. To intelligently make a decision consideration must be given to the finances of the district, availability of materials, local materials, the kind and volume of traffic passing over the road, possible increase in traffic due to the improvement and the approximate cost of maintaining any type that is decided upon. Hundreds of millions of dollars have been wasted in this country by building the wrong type of road. In this State in the central section we find almost invariably macadam roads, in Western Kentucky gravel roads, and in most instances those types have been built without any consideration whatever being given to the traffic that has or will pass over the road during its life. To my mind, the selection of the proper type of road requires the highest type of engineering ability, and before building any road it would be economical, and certainly good common sense, to get the advice of the foremost engineers in the country as to the most economical type.

On many of the roads in this State, even at this advanced age, we find that it is impossible to transport the ordinary road machinery because the drainage structures will not carry the loads. Sometimes you see fairly good roads on which there has been installed drainage structures totally unsuited to the traffic. We also find that structures of the wrong size have been built; it is not uncommon to see a 100-foot span trestle where perhaps a 4x4 culvert would suffice. Oftentimes we see a culvert pipe installed which is totally incapable of carrying the water, and even the determination of the proper size of any drainage structure is a high-class engineering problem. Everyone should know by this time that the design of culverts and bridges is a branch of engineering that requires years of training and experience.

No railroad company would consider for a moment letting one of their section foremen build a bridge or culvert according to his own ideas; on the contrary, every structure is carefully designed, carefully checked several times before it is ever allowed to be installed. The great trouble with highway work has been that most everyone thinks they understand how to design and build drainage structures, and we find today our highways adorned with structures which have little to commend them, except the enormous prices paid by an unknowing public.

After a road is built, it must be maintained, and everyone who has had any experience in road maintenance knows it should not be attempted by any but experienced men, because it is one of the easiest ways known to waste money. Just what to do to a road in certain stages of deterioration is one of the most difficult things for even the most experienced engineers to determine.

I have seen some men use 500 cubic yards of stone to the mile and make less showing and do less good than an experienced man would with a hundred yards of the same material.

It has always occurred to me as being peculiar that separate accounts have not been kept showing the expenditures which have been made on a road. Today it would

be impossible to go to any county in this State and find the cost of a single mile of road unless that mile had been built under State supervision, where cost records are accurately kept. It is part of the training of an engineer to analyze costs, to segregate costs so that they know not only the original cost of any improvement, but also what it has cost from year to year. Only by keeping and knowing such things can we ever be certain that we are doing economical work.

I have endeavored to show you that every phase of road building is an engineering problem, and the sooner that fact is realized the sooner will the tax-payers be properly protected. But the thing I am contending for will not come over night. Men without any knowledge of the subject will be elected to office on some fake issue and will continue to build roads according to their own pet theories, many of which will be at variance with good engineering; but the taxpayers should remember that they are paying for all mistakes made.

Never before in the history of the world has mankind been so dependent upon the engineer. The existing war is essentially a war of engineers, for it is they who are designing the guns, designing the ships, the gas bombs, the depth bombs, the aeroplanes, the ammunition, building the roads, cantonments, the trenches, railroads and bridges for our armies, and the public is now beginning to recognize the truth of the saying that "when something of importance has to be done, it is necessary to call in the engineer."

Remember, that engineers have always existed and that there will at all times be sufficient work for them, and they will be sought after, so it is not a question of trying to create positions for them. The people should realize that they, more than the engineer, will be benefitted by his services, and, when the sentiment demands, engineers always have and always will qualify for the position. There is almost no engineering feat that cannot be accomplished.

Noted men have made the statement that of the \$300,000,000 expended in this country on roads last year that at least one-third was wasted, and it is now time for the people to take this matter in hand and see that not a single piece of road work is attempted unless done by skilled engineers; then every cent expended on location will be a permanent investment, every fill and every cut that is made will be properly done, every bridge and every culvert built so that it will carry the loads that pass over the road. The type of surfacing used will be the most economical one, and the roads, when once built, will be maintained instead of being allowed to deteriorate from day to day.

Every cent expended will be properly accounted for, and then, and only then, will the taxpayers realize a dollar's worth of work for every dollar of their money invested in roads. When such time shall come the people will be willing to pay taxes for roads, because they will see that their interests are properly safeguarded and we will have more and better roads at a cheaper price.

Reinforced Concrete Steamship

The reinforced concrete steamship "Atlantus," 3500 tons carrying capacity, was successfully launched recently at the yards of the Liberty Shipbuilding Co., Brunswick, Ga.

The Atlantus is the first of the concrete ships contracted for by the U. S. Shipping Board Emergency Fleet Corporation to be finished. Sister concrete ships as well as a number of concrete ships of 7500 tons capacity are being built in the yards of the Liberty Shipbuilding Co., and in four other yards established by the government exclusively for concrete ship construction.

A New Type of Conveyor

That Reduces the Cost of Handling Coal, Coke, Ashes,
Sand, Etc.

To secure economical operation and greater efficiency in handling material, labor must be supplanted by machines and these selected which are best adapted for the particular work. Men with wheelbarrows are too costly to use in storing, moving or loading material but, at the same time, the old style conveyors required a great deal of labor in shoveling the material up into the receiving hoppers.

A new type of portable conveyor, which cuts the labor of feeding one-half, is shown in the accompanying illustrations. The most distinctive feature of this machine, called the Scoop Conveyor, is the scoop on the feeding end, which can be pushed or completely buried into the material to be conveyed. This makes it possible to simply scrape the material onto the carrying belt instead of lifting it up by shovelfuls into the feeding hoppers of ordinary conveyors.

Another exclusive feature of this machine is the construction of the sides or skirt plates as they are called. These form a trough which enables a 12 inch wide belt to equal in carrying capacity a 20 inch ordinary

It is due to the skirt plates, also, that a 24 ft. long Scoop Conveyor will convey material as high as a 30 foot troughed belt. The resultant saving in belt expense is considerable, as two new 12 inch x 24 ft. Scoop Conveyor belts can be purchased for the price of one 20 inch x 30 foot troughed conveyor belt.

While the Scoop Conveyor has been on the market only a short time, the manufacturers state that there are now over 1,000 in use and that they are receiving over 50 per cent repeat orders. This would seem to indicate that the machines are giving good satisfaction to their owners.

Actual Savings

The money savings resulting from the use of a Scoop Conveyor are due, first, to the saving in labor, second, to the speed at which material is conveyed. In comparison with handling material by hand, one or two men with a Scoop Conveyor will do the same work as from four to twelve men, depending upon conditions. The Scoop Conveyor will load trucks in one-fourth to one-sixth the time required by men shoveling. It often enables one truck to do the work of two trucks and of getting two days work done in one day.

Storage capacity is another factor of saving attributed to this machine as it increases the available capacity of a shed or yard space by enabling the men to pile higher.

A few statements of actual savings made by the use of this machine may be of interest:

Gay Bros. Co. (Cavendish Woolen Mills), Cavendish, Vt.

One man now used instead of four to pile coal for storage and to move it into boiler house. Average saving is \$7 per day.

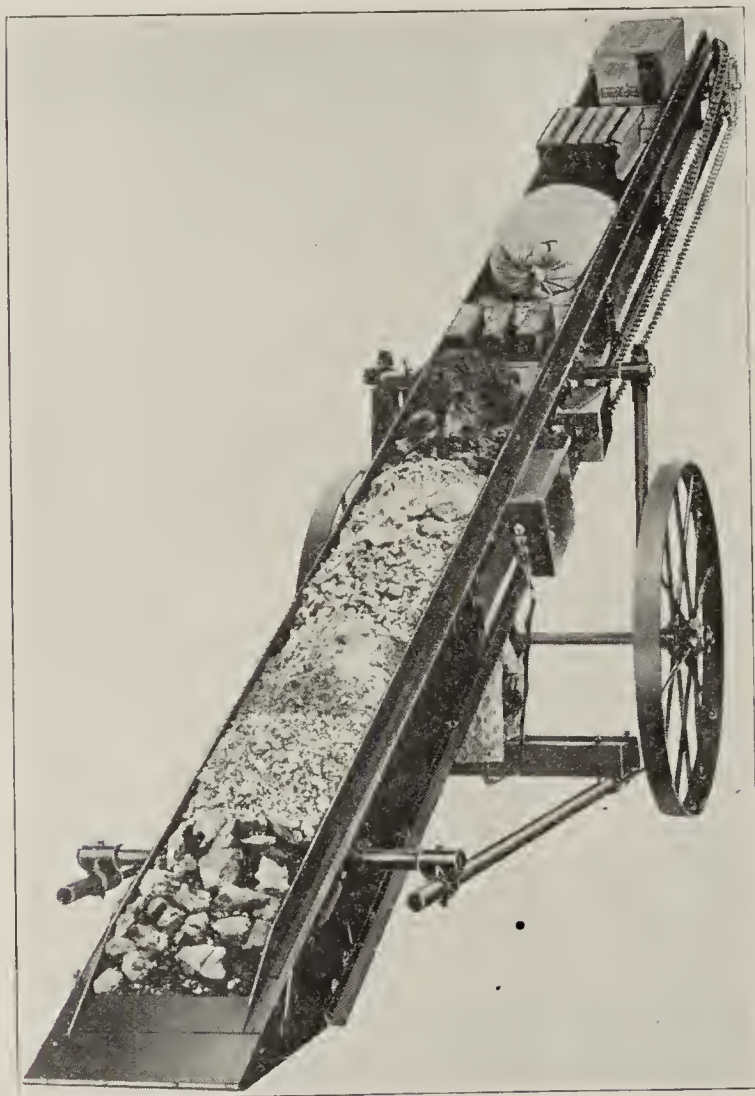


Fig. 1. Glimpse of Loaded Portable Conveyor, Showing How Variety of Materials Can Be Handled at One Time.

troughed belt. This is readily understood when one remembers that on a troughed belt, the material is carried in the center or trough, that on the sides falling into the trough or rolling back, whereas, the side plates on the Scoop Conveyor hold the material together giving the whole width of the belt carrying effectiveness.



Fig. 2. View of Conveyor Unloaded, Ready for Use.

Baird Machine Co., Bridgeport, Conn.

Reduced yard force from five men to one. Now unload coal from cars quickly without having to pay demurrage charges.

Fonda Glove Lining Co., Fonda, N. Y.

Load from 2 to 3 tons of soft coal from ground into auto trucks in from 3 to 5 minutes.

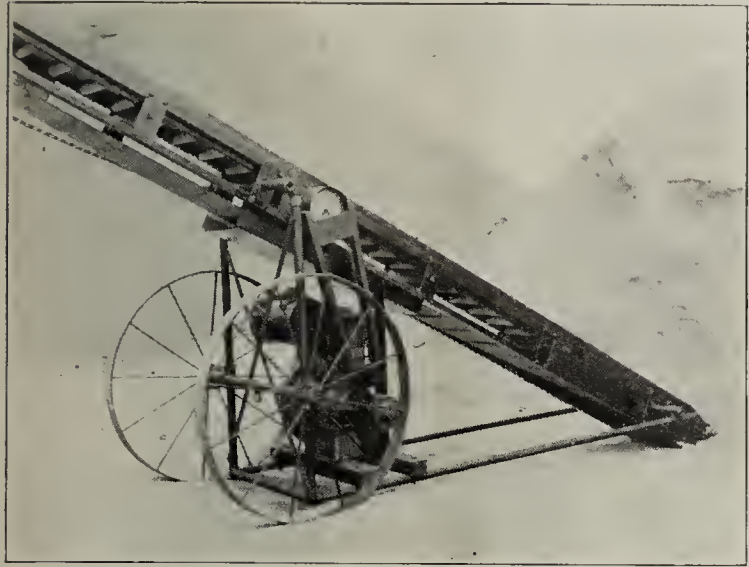


Fig. 3. Glimpse of the Gasoline Engine Arrangement Underneath Portable Yard Conveyor.

Colonial Steel Co., Pittsburgh, Pa.

unload coal from cars quickly without having to use conveyor at 50 per cent of former cost. They figure machine has paid for itself more than once in a year.

J. L. Prescott Co. (Shoe Polish Manufacturers), Passaic, N. J.

Former cost of unloading coal from cars and putting it into storage bins was 28 cents per ton. It is now done with a Scoop Conveyor at 4 cents per ton or a saving of 85 per cent.

Marcus S. Wright (Miner of Foundry Sands & Clays), South River, N. J.



Fig. 4. View of Portable Conveyor Showing Its Easy Adaptation for Hand Locomotion Within Yard.

Before using the Scoop Conveyor employed 6 men to load railroad cars. Now do the work with three men and get out larger tonnage. Load 150 to 175 tons of silica sand into cars with Scoop Conveyor in a 9 hour day with 3 men which was impossible with 6 men working without the machine.

Capacity and Uses

The carrying capacity of the Scoop Conveyor, based on handling coal, is one ton per minute, provided a sufficient amount of coal is maintained at the receiving



Fig. 5. Portable Conveyor Loading Coal Direct from Bin to Truck.

end of the machine. If the storage pile is of sufficient height, one man can easily feed one ton in one and a half minutes, or if the pile is low, he may require from two to four minutes. Where speed is required two men may be provided for feeding. In unloading hopper bottom cars the machine and one man can remove one ton per minute.

Large size coal, coke, crushed stone, etc., fed by one man require from three to six minutes for one ton or half that time with two men.

The Scoop Conveyor is used principally for storing, reclaiming and loading bulk material and light articles. There are an unlimited number of uses for the ma-



Fig. 6. How the Portable Conveyor Can Still Be Used "In a Pinch" Where Space Is at a Premium.

chine, in addition, such as elevating material to tanks or platforms in chemical and industrial works, feeding from cars and delivering into fixed conveyors or stoker magazines at power plants, etc. Almost any kind of material can be handled, such as coal of all kinds, ashes, sand, earth, crushed stone, blast furnace slag, ore, fertilizer, salt, chemicals, grain, bags and light packages.

The Scoop Conveyor may be used singly, in tandem or in triplicate as may be required. The employment of sets of two or more allows for an increase in height of the storage pile or conveying distance. Fig. 7 illustrates three machines raising coal or crushed stone easily up a long steep grade over a long range.

Construction

As may be seen from Fig. 1, the Scoop Conveyor is strongly constructed, light in weight, compact and portable. The steel frame holding the rollers and conveying belt is mounted on the wheels so the balance is perfect. One man, by inserting the pipe handles into

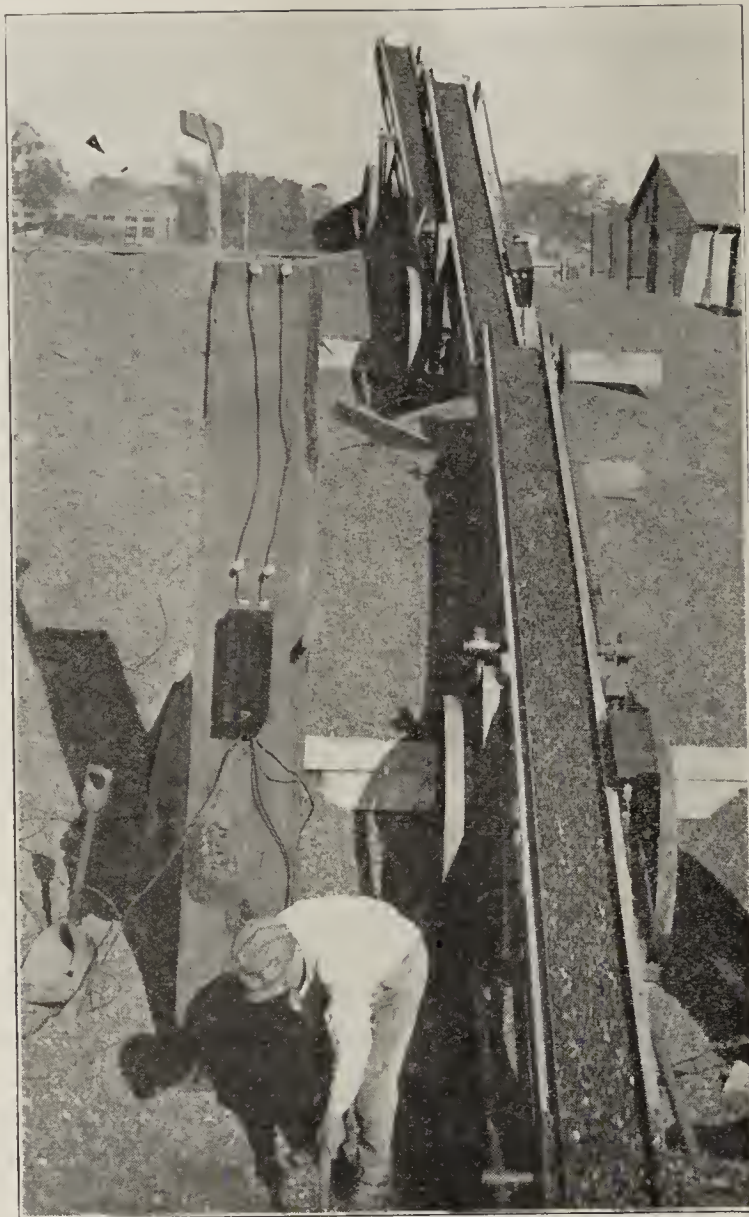


Fig. 7. A Novel Use of Three Conveyors Raising Coal or Crushed Stone Easily Up a Steep Grade and Over a Long Range.

the ends of the horizontal members, can easily lift and move the machine around.

The electric motor or gasoline engine mounted under the frame transmits power to the conveyor by means of a chain and sprocket connection to a shaft extending beneath the conveyor. From a sprocket on the other end of this shaft the power in turn, is transmitted to the driving sprocket, located at the upper end of the conveyor.

The carrying belt is a high grade of heavy duck and rubber conveying belt and duck cross strips. These transverse cleats are provided to prevent the material from slipping back down the incline.

The Scoop Conveyor is made in three different sizes, 18 feet 8 inches, 10 feet 8 inches and 24 feet. The width of the conveying belt on any of these sizes may be either 12 inches or 16 inches wide as desired. Size 13 feet 8 inches elevates to a total height from the ground of 5 feet 9 inches, the 19 foot 8 inch size may be adjusted for any height from 6 feet to 9 feet, and 24 foot size may be adjusted for any height from 9 feet to 12 feet. The machines are furnished with either electric motor or gasoline engine, or where customer prefers to furnish and install motor himself, motor support and drive from motor shaft are provided.

For catalogue and other information address the manufacturers, THE PORTABLE MACHINERY CO., Inc., Passaic, N. J.

Prices of Sand Not Excessive

Denial of "combinations in restraint of trade" were made by Chicago sand producers and dealers before the committee of the Illinois General Assembly recently appointed to investigate the alleged existence of unlawful trade combinations among producers of building and road materials. The evidence tended to show that the greatest profits in the sand business came at the pits on value placed on the raw products by the producers.

J. W. Adler, president of the American Sand & Gravel Company, was the most important witness. Examination by Senator Kessinger brought out the fact that he was also president of the Hydraulic Sand & Transit Company, which sold sand to the American corporation.

Mr. Adler was forced to admit under cross-examination that as president of the Hydraulic company he fixed the price at which the American Sand Company was forced to buy its sand. As head of the latter company, at the same time, he agreed to the purchase price.

Adler attributed the high prices of sand to cost of labor and freight rates. He estimated that it cost \$2.38 to produce a cubic yard of sand ready for ultimate delivery. He divided the cost as follows: Value of sand in pit, 55 cents; freight, 75 cents; teaming, 80 cents; war tax, 3 cents, and overhead, 25 cents. This would justify a price of \$2.50 to \$2.75, he testified.

Other witnesses testifying were A. B. Sheflar and Arthur M. Lewis, formerly connected with the American Sand & Gravel Company. All protested that the price of sand was not excessive. Prospects of reduction, they declared, depended entirely on reduction in the prices of coal, freight rates and labor.

John M. Bos, president of the J. M. Bos company and of the Indiana Bank Sand company, was the other witness. Sand which is sold in Chicago at \$1.14 a yard is purchased from the Indiana company by the Bos company for \$1.50 a carload, cars holding thirty to forty yards, according to Mr. Bos. He owns 98 per cent of the Bos company stock and 70 per cent of the Indiana company stock.

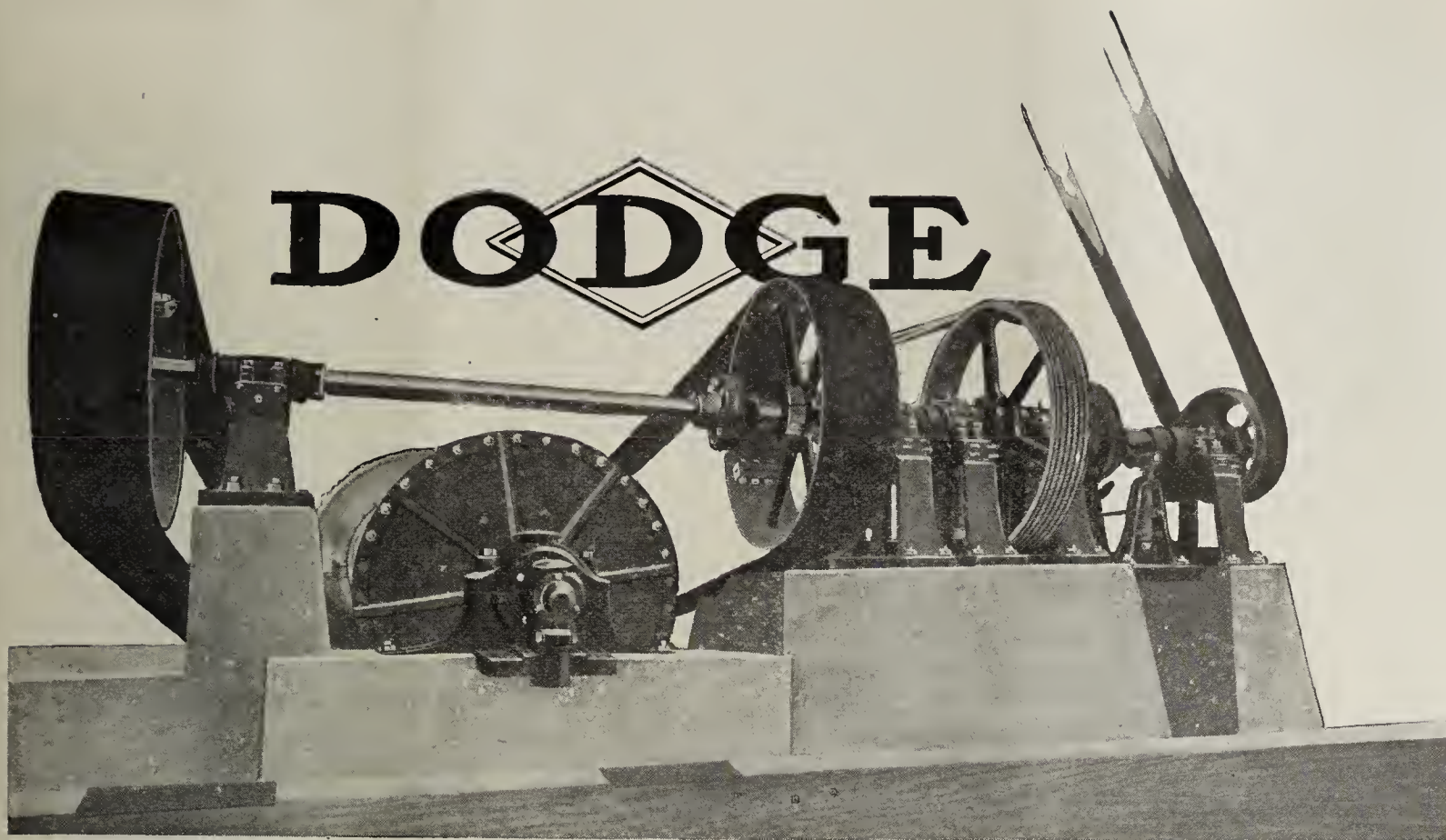
Cement Plant Sold by Alien Property Chief

The plant of the La Salle Portland Cement company, formerly the German-American Portland Cement works, La Salle, Ill., was sold by representatives of A. Mitchell Palmer, alien property custodian.

The controlling interest in stock was bid in by a coterie of men who represent other cement plants. The other active bidding element came from La Salle, Ill., where the plant is located.

The "book value" of the stock, as determined Jan. 31 by certified accountants, is about \$983,000. The total value, according to the price paid at the sale is \$1,287,000, or about one-third more than the book value.

Among those that made the successful bid were A. Y. Gowen, vice president of the Lehigh Portland Cement company; Charles Voettcher, president of the Cement Securities company of Denver, a holding company that controls several plants; A. C. Dustin of the Sandusky Cement company of Cleveland, O., with plants at Dixon, Ill., Sandusky, O., and Syracuse, Ind., and C. H. McNiden, president and general sales manager of the Northwestern States Portland Cement company.



"Everything for the mechanical transmission of power"

The Dodge plant is equipped to build complete installations as well as stock products; there is a relation between the two, of course, and when time lost through faulty erection is of double value, it is a point well worth considering, that every part of your transmission equipment be built and tested in one shop.

The Dodge line of stock products contains everything for the mechanical transmission of power.

Pulleys—wood, iron or steel; solid or split; hangers, bearings, collars, clutches and couplings are the component parts of either line of countershafts.

Sheaves, pillow blocks, bearings, clutches, collars, couplings and rope constitute the major part of a rope drive equipment.

Sizes of the units may vary; often the outward appearance is changed, but the principles upon which stock products are made remain constant always.

A stock bearing of the ring-oiling type is expected to render a specified

service for a given shaft size; special ring-oiling bearings, for a 16-inch shaft, vary in design and size, but not in the service they will render.

Likewise a rope sheave—36-inch sheaves are not built by the same methods as are those whose diameter is twenty-one feet and whose face carries fifty-six grooves; but both will give the ultimate of service for the work intended.

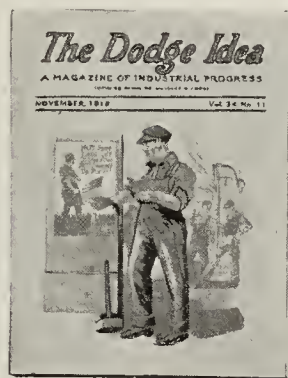
The point is this: Suppose you have in mind an addition to your present plant—you require a certain amount of stock products and certain "special" equipment necessary for the solution of intricate power transmission problems:

Put it up to a Dodge dealer—then, and only then, can you be sure of standardized service throughout your equipment.

Dodge, Oneida and Keystone dealers are in every important city. They carry complete stocks of transmission appliances. Call on them for what you want when you want it.

Dodge Branch Warehouses

Philadelphia	815 Arch St.
Cincinnati	128 W. Third St.
New York	21 Murray St.
Chicago	208 S. Clinton St.
St. Louis	408 N. Fourth St.
Boston	137 Purchase St.
Atlanta	20 S. Forsyth St.
Pittsburgh	337 Second Ave.
Minneapolis	100 N. Third St.
Dallas	Gt. Southern Life Bldg.
Providence	171 Pine St.
Seattle	522 First Ave., So.
Newark	281 Market St.



Throughout 1919 "The Dodge Idea" will contain many articles of interest and value to manufacturing executives and heads of mill and factory departments. We want every owner, manager, superintendent, master mechanic, chief engineer and purchasing agent of power-using plants on the mailing list.

Dodge Sales and Engineering Co.

Distributors of the Products of the Dodge Manufacturing Company

General Offices and Works: Mishawaka, Indiana

4 Crushed Stone Concerns Form \$1,500,000 Unit

Consolidation of four of the largest crushed stone companies operating in or near Chicago, with the Producers' Material company, formerly a sales and delivery organization, was recently perfected.

The transaction gives the concern control virtually of about one-fourth the crushed stone used in building operations in Chicago, and according to Charles A. Klotz, its president, the result will be to effect economies in distribution.

The value of the properties merged exceeds \$1,500,000, and includes the quarry of the Illinois Stone company at Lamont; two quarries of the Universal Crushed Stone company at Racine, the quarry of the Artesian Limestone company at Grand and Campbell avenues, Chicago, the quarry of the Argo Stone company at McCook and a lease held by the Argo company on a quarry owned by the Chicago Union Lime Works company at the same place.

Although known as a separate corporation, the Universal Crush Stone company had been controlled by the Illinois company, which also surrendered its fleet of barges and tugs, as well as dock facilities to the Producers' corporation.

"The idea of a trust is absurd," Mr. Klotz said. "The properties acquired by the Producers' Material company have been owned by the same interests for some time. The only purpose of the consolidation is to simplify the organization, avoid duplication, and co-ordinate operation to secure greater efficiency and reduce cost of production.

"The agitation in this vicinity with reference to the supposed high cost of building materials is without foundation. As a matter of fact, when the higher freight rate and increased cost of teaming and labor are taken into account, the amount realized by the producer of building materials today is no more than before the war.

"Prices in Chicago also are anywhere from 25 to 50 per cent less than prices for similar materials in other large cities. For example: The price of crushed stone f. o. b. quarry is quoted today at 80 cents per ton in Chicago, \$1.25 in Buffalo, N. Y.; \$1.35 in Kansas City, \$1.50 in Detroit, and \$1.80 in Toledo."

New Concrete Product Factories

The Hansel Coal Co., a coal and building material firm at Kokomo, Ind., has just completed its new factory for the manufacture of concrete blocks. The new plant is equipped with modern machinery of the latest improved type including a Kent continuous mixer, and in addition to the block industry, they will also manufacture concrete drain tile of all sizes, ranging from four to twelve inches, having purchased a Dunn tile machine. Almost every appliance for the quick handling of cement, sand and coal has been installed at the new plant. Bulk cement in carload lots will be unloaded in bins by special conveyors. This plan, it is pointed out, will save considerable manual labor, and prevent waste. The steam dry room for the drying of cement blocks is one of the features of the new plant.

Herman Smith and Frank Livinstow of Randolph, Wis., are building a plant where they will manufacture concrete drain tile. They are making arrangements to have the business running at an early date and are expecting to put considerable money into the business in the purchase of the latest Dunn tile machinery.

Cement Plant Must Cease Dredging Marl

Through the passage of the conservation bill in the Indiana assembly, the Sandusky-Portland Cement Co. of Syracuse, Ind., which employs several hundred people, will be put out of business.

The Sandusky-Portland Cement Co. is operating a dredge at Lake Wawasee much against the wishes of the cottagers, who maintain that the holes dug in the lake by the company is ruining its beauty. They also object to the dense clouds of smoke coming from the dredge, which makes camping a discomfort.

The cement company is about all there is in Syracuse, most of the population being employed at the plant. Residents declare that with the passing of the cement company, the town will also pass. The bill was objected to most strenuously by the entire population of Syracuse, who are much wrought up over their future prospects.

The conservation bill will force the cement company to discontinue their dredging operations, and without dredging they cannot exist.

Westinghouse New Annual Catalogue

The Westinghouse Electric & Mfg. Co. of East Pittsburgh, Pa., has issued a complete catalogue in which all of their electrical supplies are listed. In compiling the catalogue every effort was exercised to make it of the greatest convenience to purchasers.

The catalogue is made up of 1,264 pages of description pertaining to the products of the company and a score of other pages contains a complete cross index, and index to style numbers, and a table of "Approximate Cost Multipliers," which enables one to figure the approximate cost of all supplies listed.

Although the book is called a catalogue it contains a vast amount of information of a technical and engineering nature. Practical suggestions for the use of many kinds of apparatus for the transmission and utilization of electric power are given.

It is planned to issue this catalogue annually. The publication of this catalogue is quite noteworthy as it is the first book of such a nature published by an electrical concern having the wide diversity of products sold by the Westinghouse Company.

Belting Efficiency for Transmission Conveying and Elevating

In every successful business there seems to be only one man—at the outside but two or three—capable of pulling the business out of the rut of precedent and tradition.

Even in the engineering department—in face of constant advances being made by science in every direction—the tendency is to "let well enough alone." This is shown in the persistent use of the traditional belting which never grows twice alike.

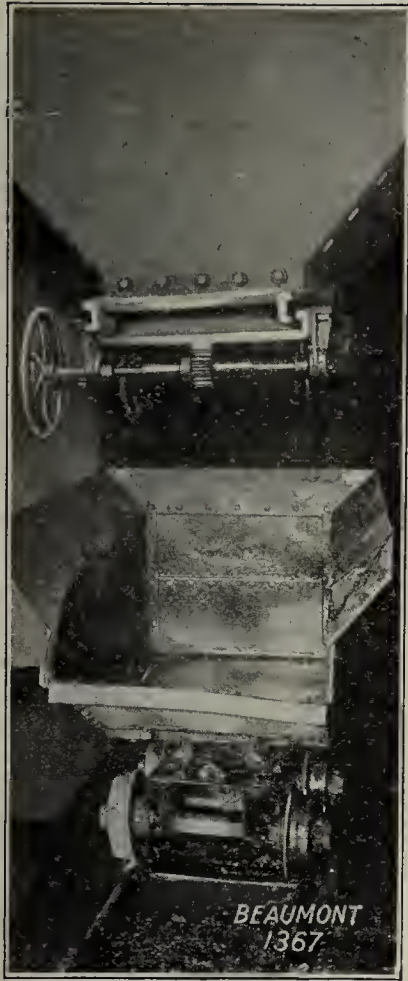
Power makes money only when delivered at the tool or machine.

Of what use is it to buy coal by the B. T. U. when inefficient transmission is wasting a quarter of the power delivered before ever it gets to work?

Too long has belting for transmission and conveying been thought of as so much merchandise, to be sold by the yard over any dealer's counter.

Black Giant Doubled Stitched Belts are the scientific answer to the power transmission problem in nineteen classes of industry.

Rack and Pinion Slide Gate



Particularly suitable for bottom dump hoppers when material contains large lumps.

This type of gate should be used only in connection with a large collecting car.

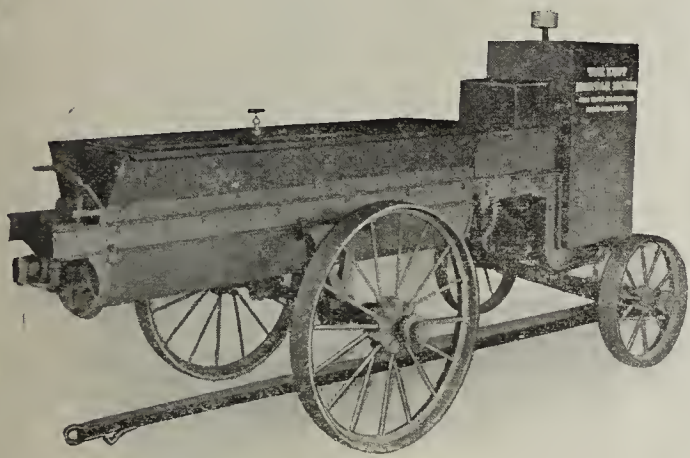
For details get our catalog No. 37.

**Beaumont
Mfg Co.**

340 Arch St.
Philadelphia

The Kent Mortar Mixer

The Best by Every Test



This machine eliminates all hand labor from the operation of mixing mortar.

This one machine has a capacity for supplying from fifty to sixty masons.

It is indispensable on the large contract.

We will be pleased to furnish data

The Kent Machine Co.

Drawer D

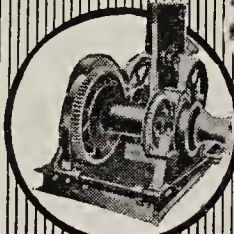
Kent, Ohio

The Dawn Of A New Era In Building

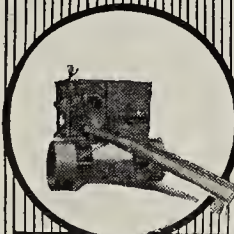
**Are You
Ready?**



**HIGH SPEED
Boss**
CONTRACTOR'S EQUIPMENT



HOISTS

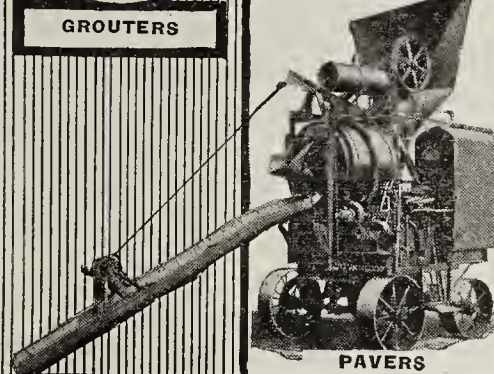


GROUTERS

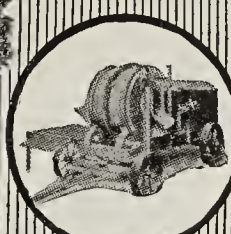
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Equipment Will
Make You Money.**
Contractors Use Our
High-Speed Built-of-Steel
Hyatt Roller-Bearing
Equipment and Beat
Competition in Cost,
Speed and Quality
of Work.

**PAVERS
BUILDING MIXERS
HEAVY DUTY HOISTS
ELEVATORS
GROUTERS
BACK FILLERS
PUMPS**

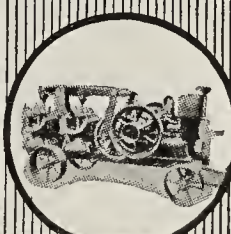
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our nearest office for
catalog, prices and in-
formation. Do it now;
don't delay.



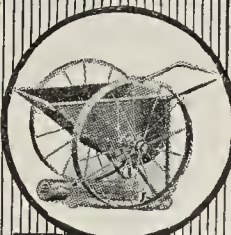
PAVERS



LOW CHARGERS



PUMPS



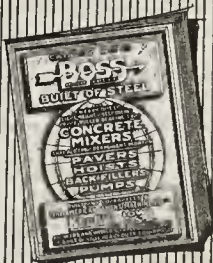
CONCRETE CART

The American Cement Machine Co. Inc.

Keokuk Iowa
(THE 300,000 HP. ELECTRIC CITY)

New York,
Pittsburgh,
Atlanta,
Richmond,
Cambridge, Mass.,
Indianapolis,
Chicago,

New Orleans,
Minneapolis,
Seattle,
Spokane,
Denver,
St. Louis,
Louisville,
Springfield, O.



They are in no sense a substitute for any other type belting but are the material part of a service which is designed to increase the efficiency of the whole power plant.

They are a known quantity. Many of them have been in continuous service thirty years or more.

They are various-ply—doubled stitched, impregnated with a special composition, treated, stretched and aged so as to form a pliable belting material well-nigh indestructible.

Their great advantage is due to their being built for their purpose and to the fact that in building them we are not dealing with the variations and uncertainties of a natural product.

Tensile strength, tractiveness, resistance to dampness, abrasion and heat, are definitely built into these belts. "We produce from the beginning a belt especially adapted to the work it is to do," writes the McIlroy Belting & Hose Co.

Most engineers think backward about power transmission. They think from the belt to the work. We think from the work to the belt.

The result of looking into this matter of power saving through the installation of scientific belting has surprised many a factory operator.

The elimination of stretch and slip, the speeding up of machines with no increase of engine speed and no more expense for fuel, the saving of time that was formerly taken up in frequent belt dressing, the longer life of belts, their freedom from troubles caused by running in damp, gaseous or hot conditions—these are matters of record in leading plants in nineteen of the principal industries in the United States and Canada.

The McIlroy Belting & Hose Co., Hammond, Ind., manufacturers of Black Giant Canvas Belting, would like an opportunity to demonstrate in your plant that their belt, because of its special construction and the compound with which it is treated, will give you better service.

While it is true that their present car is more costly than the old type, it must be remembered that this company has expended a large sum of money to build the most rugged and best Dump Car and the improvements which have been incorporated in their cars have necessarily increased the cost of building them. It will be remembered, however, that the additional price paid by purchasers for a good car is more than offset by the additional efficiency and the smaller repair bills, which means more efficiency, and in the end more profits.

The general design of the present "Continental" Dump Car is the same as years ago, with but few changes. The improvements, however, consist of better and stronger materials and the strengthening of members of the cars that have shown tendencies to weaken under abnormal strains. The woodwork used throughout is of the best quality Southern Indiana White Oak. The wheels have proved to be exceptionally strong and in the fifteen years that they have been manufacturing dump cars, the company claims that less than 5% of the wheels have worn out. One hundred and eight 4-yard cars built in 1903 were employed in 1913 by the Pinkerton Construction Co. at Webster, Mass., on the new Grand Trunk Line. The original purchase of the Pinkerton Construction Co. consisted of 125 four yard cars. It is known that the 125 cars have handled over three and one-half million yards of rock and earth, which means that each car has handled twenty-eight thousand yards, and that each car has been dumped and righted seven thousand times.

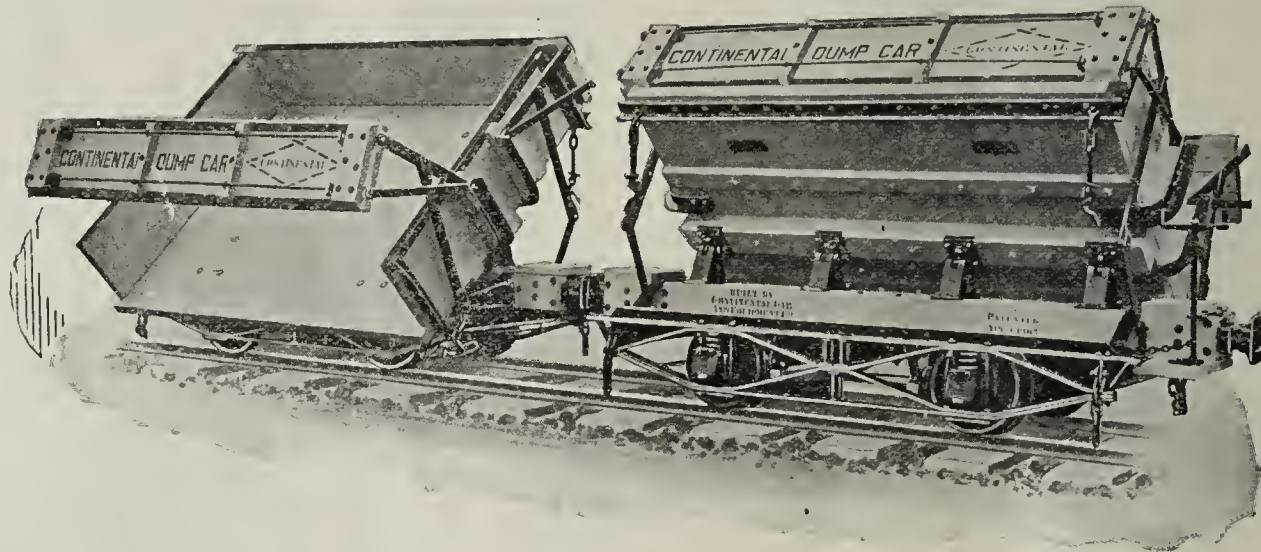
The present product of the company is a great improvement over the cars above referred to and they should beat the record of the older cars.

The more recent improvements in these dump cars are as follows:

Increased thickness of oak timbers in the floors from $2\frac{1}{2}$ " thick to 3" thick, and in the doors and ends from 2" thick to $2\frac{1}{2}$ " thick.

Equipping the doors and ends with protecting angles, and two heavier truss rods on each door.

The patent end bracing and door arm arrangements



Continental Dump Cars

There is a vast difference between the Dump Cars built years ago and the product of today of the Continental Car Company of America, Inc., manufacturers of the "Continental" Dump Cars.

Their present car is frequently referred to among Contractors, pit and quarry owners and other users of this class of equipment as the "Efficient Dump Car", the car that will stand up under the work, no matter what the conditions. It surely is a relief to a contractor to know that he has a plant which he is sure will not cause him trouble and which will or is bringing in profits.

give the ends of the cars exceptional strength in resisting loads from pushing the ends out which permits a large door displacement when the car is dumped. It is claimed that no other dump car on the market has as large a door opening.

The dumping angle has been increased from 45 degrees to 48 degrees.

The use of malleable castings throughout in place of grey iron castings.

A general catalog of the Continental Car Co. of America, Inc., giving full information concerning its products may be had by addressing them at Louisville, Ky.



The Improvement of a World Necessity

Do not overlook the opportunity
and profit it offers you.

Helm Granite Brick

Granite Faced Helm Brick

Helm pressed cement brick are faced with nature rock facings more beautiful than any clay faced brick on the market. These facings include granite, marble, feldspar, mica and other crystalline aggregates. Also with permanent mineral colors in reds, browns, buffs and other tints. The process is so simple expert labor is not required.



FREE BOOK

The manufacture of brick is as old as civilization—the demand for brick is as certain as day and night. Practically every building means a brick sale—the total brick business in your locality is large and profitable. Make Helm brick and people will buy more brick from you than from anyone else—because Helm brick (plain or faced) is an improved brick. It is stronger, more durable, faster to lay and better looking. There is not a better business opportunity open in your town than the manufacture of Helm brick, and we assure you that you can easily make it a success. It is simply a matter of your making the start.

**Helm Machines
for \$25 and Up.
Capacity to 15,000
Brick per
Day.**

Send Us That Coupon

It will not obligate you a penny's worth to let us show you the advantages of Helm brick and the large profits that are being made in its manufacture. Let us go into the matter with you very carefully.

The Helm Brick Machine Co.
593 Mitchell St.
Cadillac, Mich.

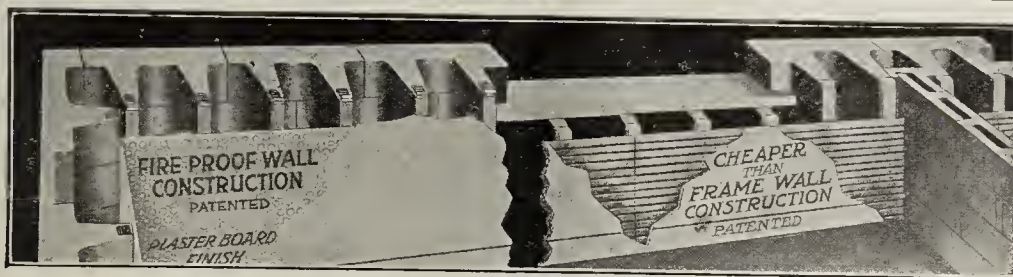
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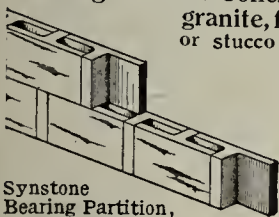


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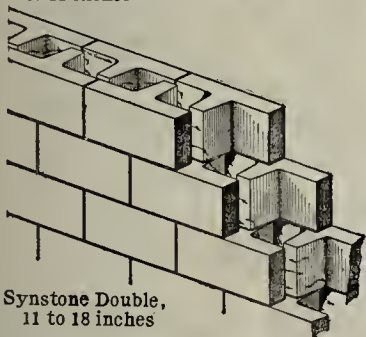
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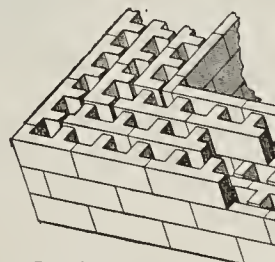
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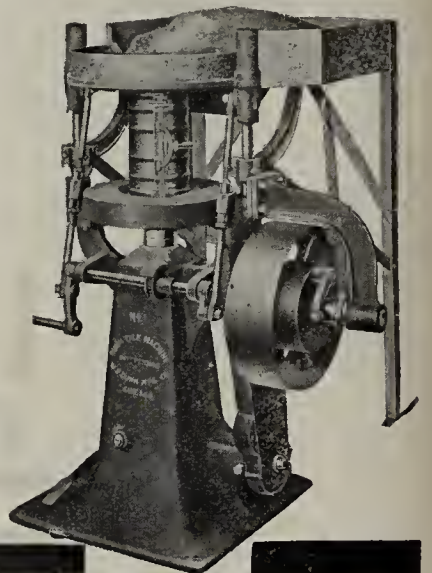
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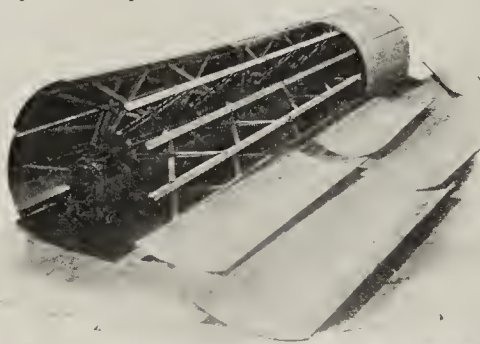
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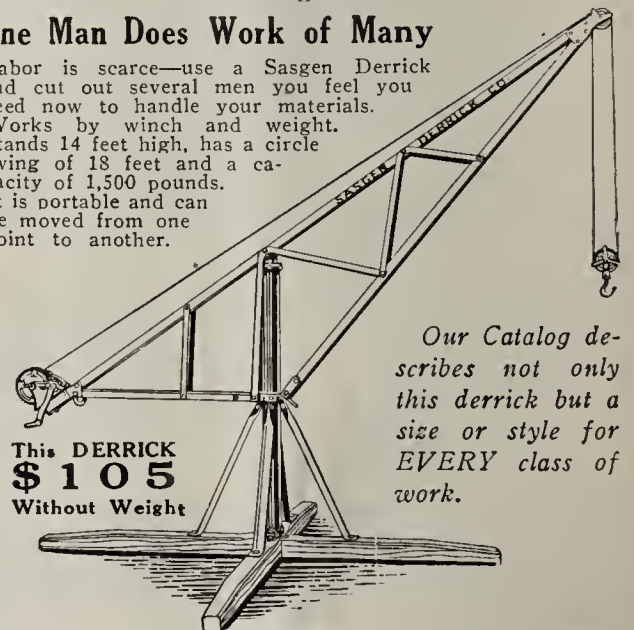
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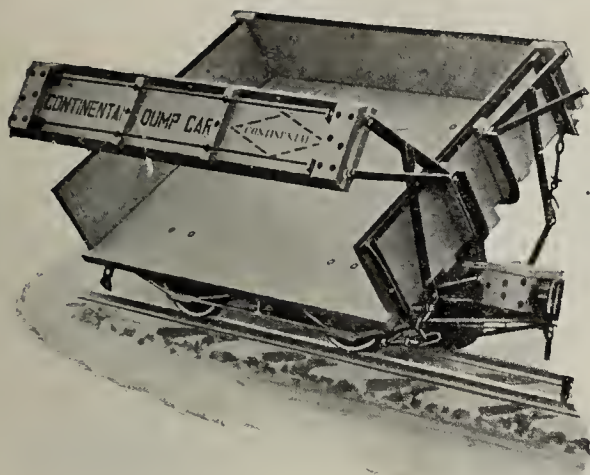
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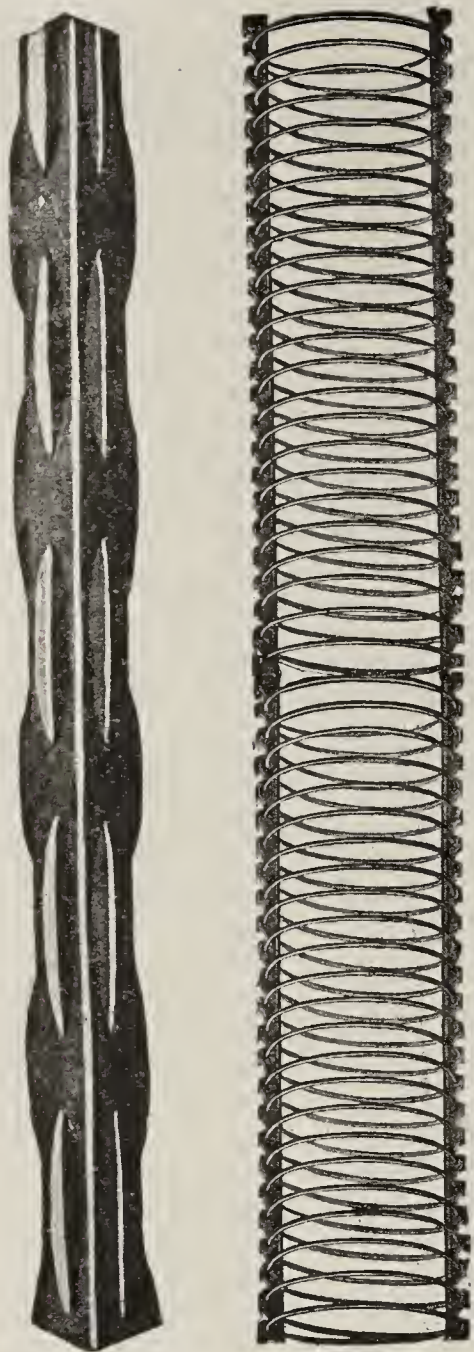
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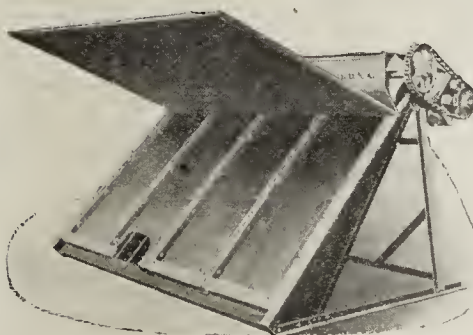
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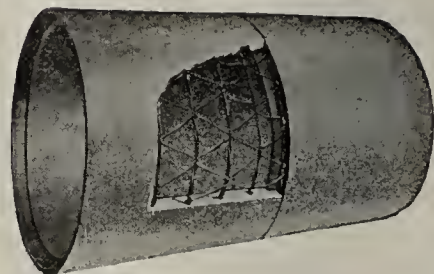
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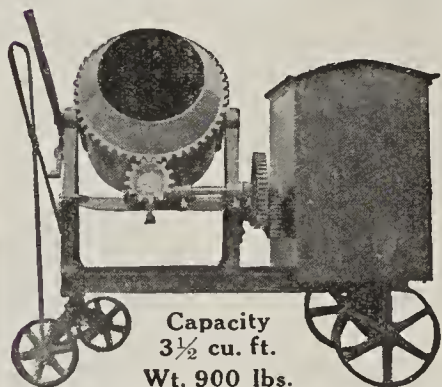
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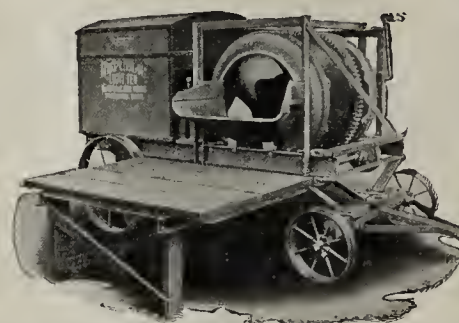
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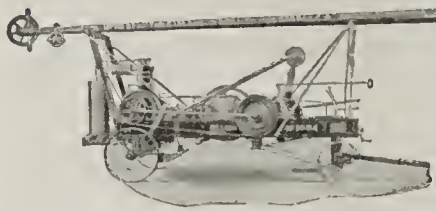
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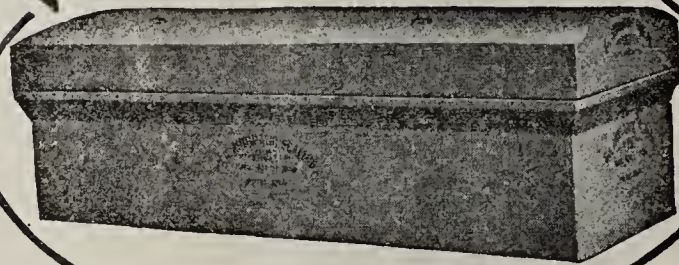
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FOR SALE AT A BARGAIN

One No. 5 Symons Gyratory Crusher
One Single Drum Belt Hoist
Five 1-yd. End Dump Stone Cars
38-ft. Elevator Complete
42-in. by 12-ft. Revolving Screen
One McKiernan Terry 3¼
Steam Drill with Bits
One Rand Pony Steam Drill
with Bits
Line Shafting
One Gravel Drag
Some 10 and 6-inch I-Beams

This equipment is in best of condition. Will sell all or in any part. For prices write

Will L. Cowdin

DELPHI

INDIANA

BELTING

"V-B" Balata

"AMPERE"

(Canvas Stitched)

"WHITE SEAL"

Write for Prices, Discounts and Samples

VICTOR BALATA & TEXTILE BELTING CO.

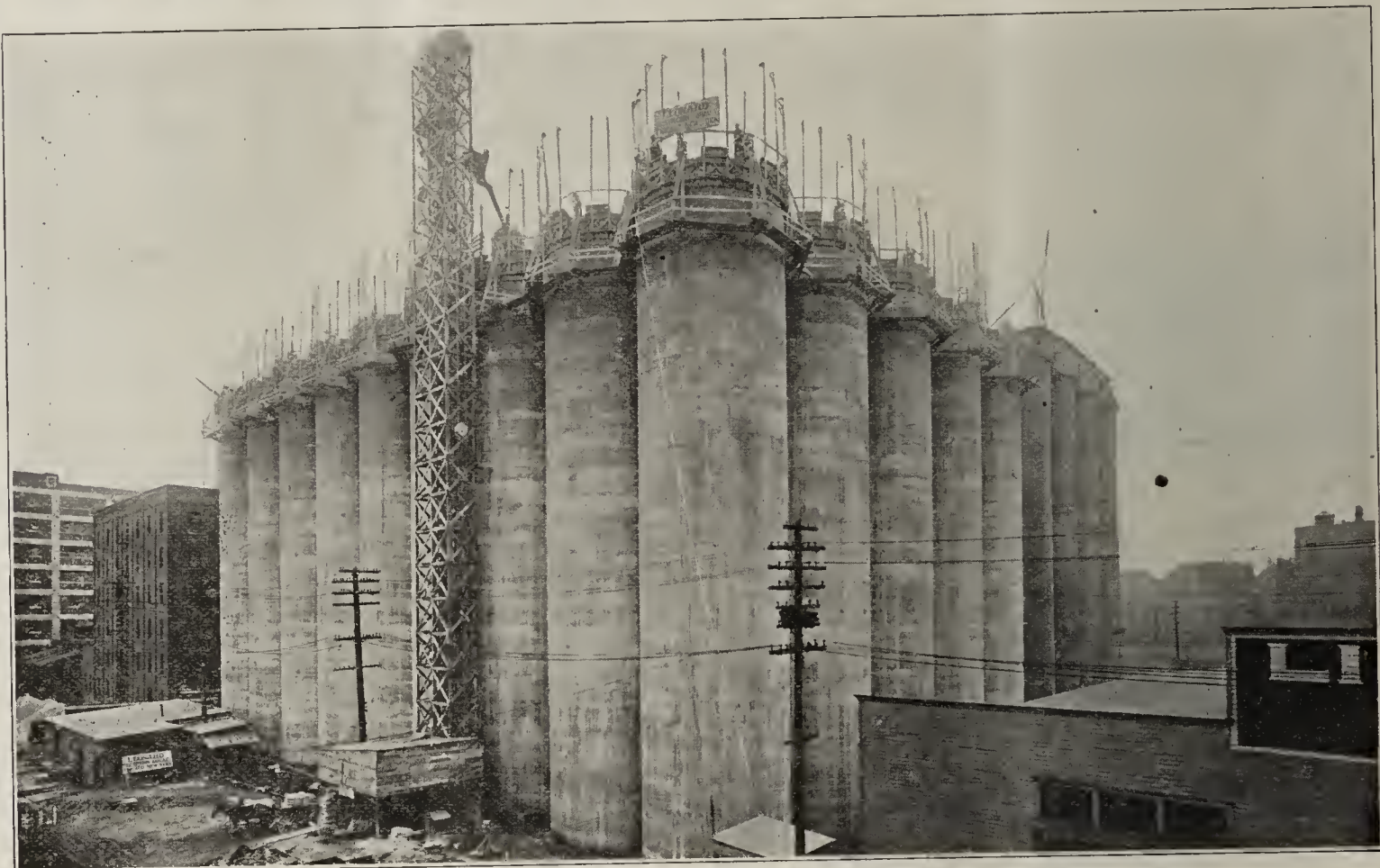
Factory: Easton, Pa. Main Office: 38 Murray St., New York

Stores: 167 N. Market St., Chicago, and 87 High St., Boston

CONVEYOR BELTS A SPECIALTY

INVESTIGATION AND EXPERIENCE ARE PROVING THE RELIABILITY OF HYDRATED LIME

FOR WATER PROOFING AND TO FACILITATE POURING CONCRETE



In these 51 concrete storage tanks, recently erected in Cedar Rapids, Iowa, by the Quaker Oats Co., there are approximately 12,500 cubic yards of concrete—1-2-4 mix. The walls are perfect cylinders, with no lips or bulged surfaces.

Hydrated lime was used for waterproofing and also to facilitate pouring the concrete and lifting the forms, owing to its lubricating properties. In mixing, 25 pounds of hydrated lime was put into each batch, which made the percentage of lime to cement a little over 8% by weight. The mixers used were of such size that three bags of cement could be used in each batch.

Considerable credit is given by the Leonard Construction Co. of Chicago to the lime. The statement is made that the lime gave the exterior surface a white and uniform appearance, and that the surface needed no subsequent coating. There were no joints where the concrete stuck to the forms and "lifted," as it does in many cases where the concrete is not of uniform mixture.

Write any of the following competing manufacturers of Hydrated Lime for complete information about Hydrated Lime in Concrete

Marblehead Lime Co.,
Chicago—Kansas City

Port Byron Lime Assn.,
Port Byron, Ill.

Lee Lime Co., Lee, Mass.
Glencoe Lime & Cement Co.,
St. Louis, Mo.

Hunkins-Willis Lime &
Cement Co., St. Louis, Mo.

Ste Genevieve Lime Co.,
St. Louis, Mo.

Palmer Lime & Cement Co.,
103 Park Ave., New York, N. Y.

Rockland & Rockport Lime Co.,
New York—Rockland, Maine—Boston

The A. & C. Lime Co.,
Canton, Ohio

Riverton Lime Co., Riverton, Va.

O. C. Barber Allied Industries John D. Owens & Son Co.,
Canton, Ohio Owens, Ohio.

Kelley Island Lime & Trans-
port Co., Cleveland, Ohio

National Lime & Stone Co.,
Carey, Ohio

Ohio Hydrate & Supply Co.,
Woodville, Ohio

Union Lime Co., Milwaukee, Wis.

Woodville Lime Products Co.,
Toledo, Ohio

Merion Lime & Stone Co.,
Norristown, Pa.

Vermarco Lime Co.,
West Rutland, Vt.

This Jeffrey Loader Saves the City of Colorado Springs \$27 a Day



Showing machine loading big auto truck owned by the street department. The truck capacity is five tons, and it is loaded in exactly 7 minutes.

Commissioner Edgar Payton of the Department of Public Works has effected this economy in the handling of sand and gravel at the city's gravel pit.

The big loader simply backs up against the face of the gravel pit, the man in charge lowers the endless chain of buckets into the gravel, turns a switch and the gravel begins to empty into the auto truck.

You want to get your share of the millions which many states have appropriated for road work. You can handle more work and make more money using a Jeffrey Loader.

Write for Loader Bulletin No. 177-L showing typical installations

The Jeffrey Manufacturing Company

914 North Fourth Street

COLUMBUS, OHIO

Handle it Mechanically

CEMENT AND ENGINEERING NEWS

with which Gravel & Stone Magazine is incorporated

22 Quincy Street, Chicago.

(PUBLISHED MONTHLY)

William Seafert, *Publisher and Editor*

J. F. Waldron, *Advertising Manager*

R. M. McCully, *Business Manager*

Telephone, Harrison 5397

Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, \$1.00 per year; all
other countries, \$1.50 per year.
Single Copies 20c.

DISCONTINUANCES—The greater part of our subscribers prefer NOT to have their subscriptions interrupted, in case they fail to remit promptly for renewal. It is therefore assumed, unless notification is given to the contrary, that the subscriber wishes to continue taking our paper. Therefore CEMENT & ENGINEERING NEWS will be sent until we are notified to discontinue—Such notice should be sent when the subscription expires.

Advertising copy or changes in ads. must be in this office by the 25th of each month, as hereafter our magazine will appear on the 5th of the following month

Advertising Rates Sent on Application

Vol. 31 CHICAGO, MAY, 1919 No 5

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TRADE **SAWYER** MARK
Registered

Stitched Canvas Belting

For thirty years "SAWYER" has been a swear-by-word among gravel, stone and cement men.

We recommend it for the particular service required in sand, gravel, crushed stone and cement plants because of the satisfactory results it has always given on this class of work.

SAWYER spells SATISFACTION. It is backed by the world's largest rubber manufacturer.

United States Rubber Company

Mechanical Goods Division



Some Record Scores

Clough-Bourne Corp., New York
 Selden-Breck Constr. Co., St. Louis
 U. S. Government---in U. S. and overseas
 The Austin Company, Cleveland
 Snare & Triest, New York
 E. I. Du Pont de Nemours Co., Nashville
 James Stewart Co., New York City
 Mason & Hanger Co., New York

39 machines

16 machines

267 machines

14 machines

11 machines

19 machines

16 machines

18 machines

Others using two to ten BOSS mixers—James Black Masonry and Contracting Co., Lord Construction Co., New York; Degnon Contracting Co., New York; Boyle Robertson Construction Co., Richmond; Chas. J. Wacker, Indianapolis; Minneapolis Steel & Machinery Co., Minneapolis; General Construction Co., Spokane; A. C. Norton, Denver; Harrison Construction Co., Charleston; John A. Hunt Co., New Orleans.

Over 5,000 Contractors Use
BOSS EQUIPMENT
 LABOR SAVERS FOR CONTRACTORS
 Get Our Astonishingly Low
 1919 Prices. Also Terms

BUILDING MIXERS
 (Concrete or Mortar)
 PAVERS
 GROUTERS

BACKFILLERS
 HOISTS
 CARTS

MATERIAL ELEVATORS

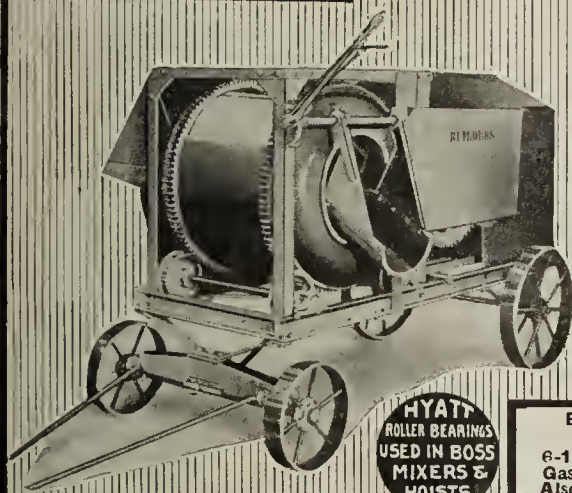
Write or Wire

The American Cement Machine Co. Inc.

Keokuk Iowa
 THE 300,000 HP ELECTRIC CITY

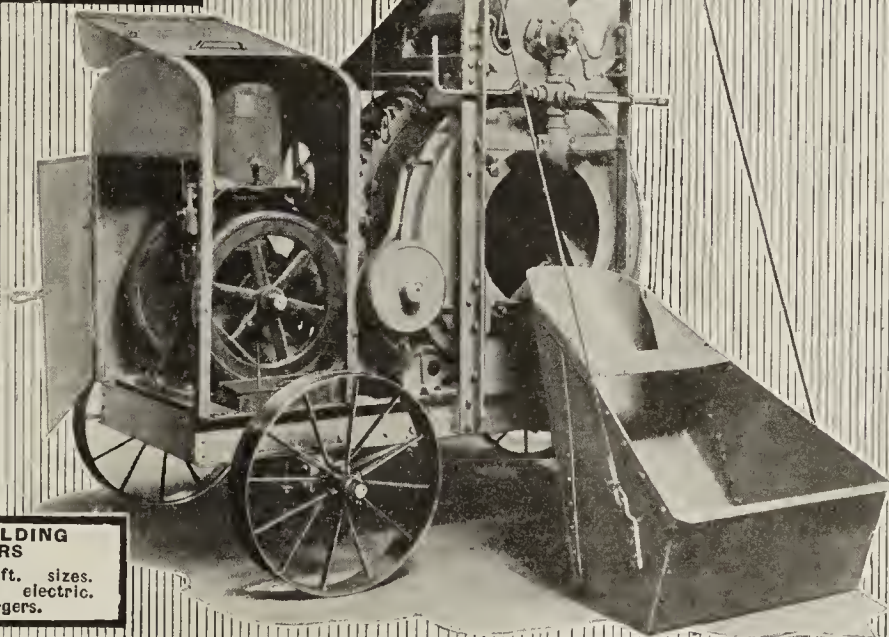
PROMPT DELIVERIES FROM STOCKS IN FOLLOWING CITIES:
 New York, Pittsburgh, Richmond, Cambridge, Mass.; Indianapolis, Chicago, New Orleans, Minneapolis, Seattle, Spokane, El Paso, St. Louis, Louisville, Atlanta, Springfield, Ohio.

BUILDERS' HANDY MIXER
 \$100 up—half-bag size, low
 charges.

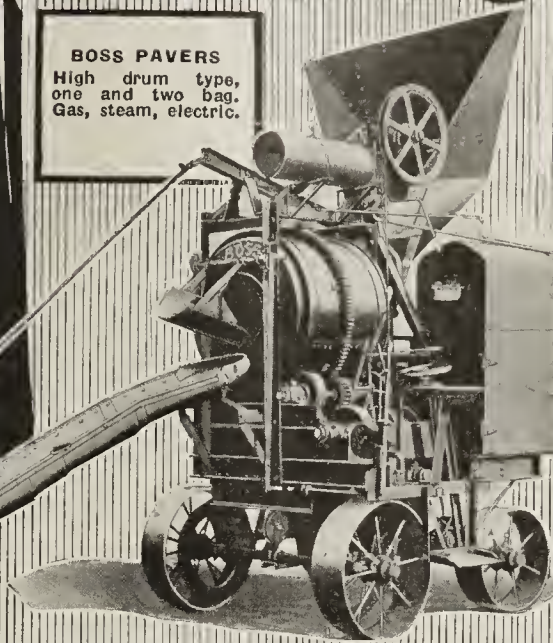


HYATT
 ROLLER BEARINGS
 USED IN BOSS
 MIXERS &
 HOISTS

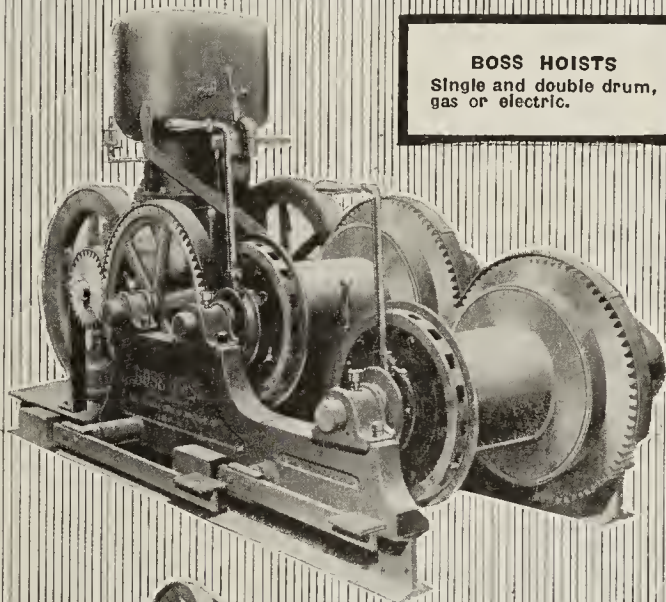
BOSS BUILDING
 MIXERS
 6-11-15-22 ft. sizes.
 Gas, steam, electric.
 Also low chargers.



BOSS PAVERS
 High drum type,
 one and two bag.
 Gas, steam, electric.



BOSS HOISTS
 Single and double drum,
 gas or electric.





LITTLE DAILY LEAKS OF POWER BOOSTS YOUR COAL BILL

The High Cost of Power Is Reduced to a Minimum By the Use of a

Plamondon Disc Type Friction Clutch

The power of this clutch is unusual. The double toggles on this clutch develop such tremendous pressure that even on the largest clutches only a hand lever is needed to engage or disengage the clutch. The geared devices usually needed to operate large clutches are unnecessary.

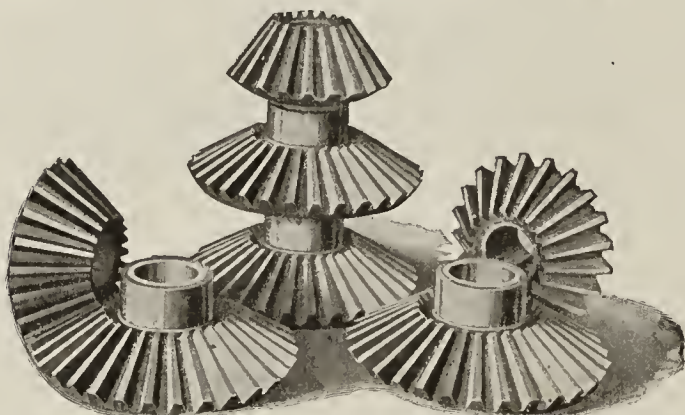
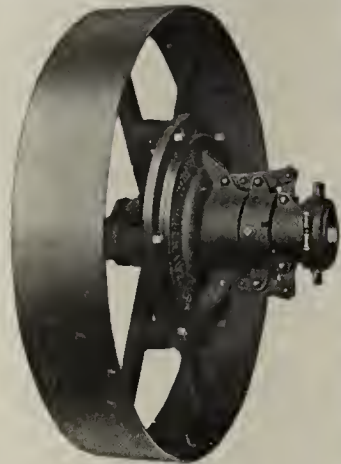
This is only one of the practical advantages the cement mills find in this clutch. Write for our new catalog No. 59 and learn the rest of them.

WE ALSO MANUFACTURE GEARS

A. Plamondon Mfg. Co.

12-24 N. Clinton St.

CHICAGO, ILL.



Make Your Gear Service a Certainty

Ganschow Bevel Cut Gears—like Ganschow Gears of every kind—are cut with an accuracy and precision which makes smooth, easy, effective working a certainty. They minimize wear and tear and insure long life to the parts. From twenty to forty per cent less power is required to operate

Ganschow Cut Gears

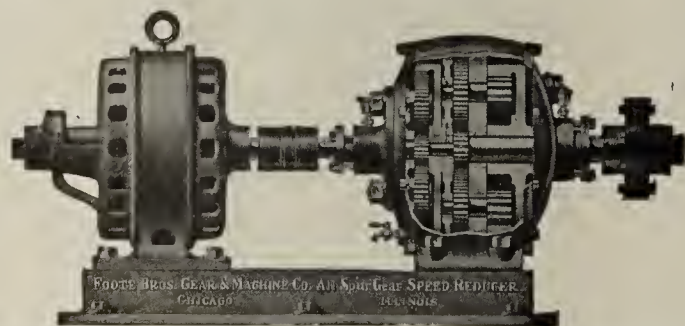
as compared with cast gears, because of evenly-thick and evenly-spaced teeth, and because they are uniformly smooth. Throughout the whole machine the jar and strain are greatly reduced; and this means gear-efficiency from every standpoint.

As specialists in gear work, our splendid facilities enable us to take care of any requirement from the smallest gear up to 12 ft. in diameter—and do it QUICK. Every gear strictly according to specifications and free from defects.

How about YOUR gear requirements?

Wm. Ganschow Company, Chicago, Ill.

1003 W. Washington Street



SPUR GEAR SPEED REDUCERS

Note they are dust proof, compact, made in any horse power or reduction. Just what is needed on conveyors, elevators and reduction of speed anywhere. We manufacture cut gears. Send for catalogue.

FOOTE BROS. GEAR & M. CO.

203 North Curtis St., Chicago

FROGS SWITCHES CROSSINGS

Portable and Industrial Track, Tie Plates, Switch Stands, Rail Braces, etc. Can make prompt shipments.

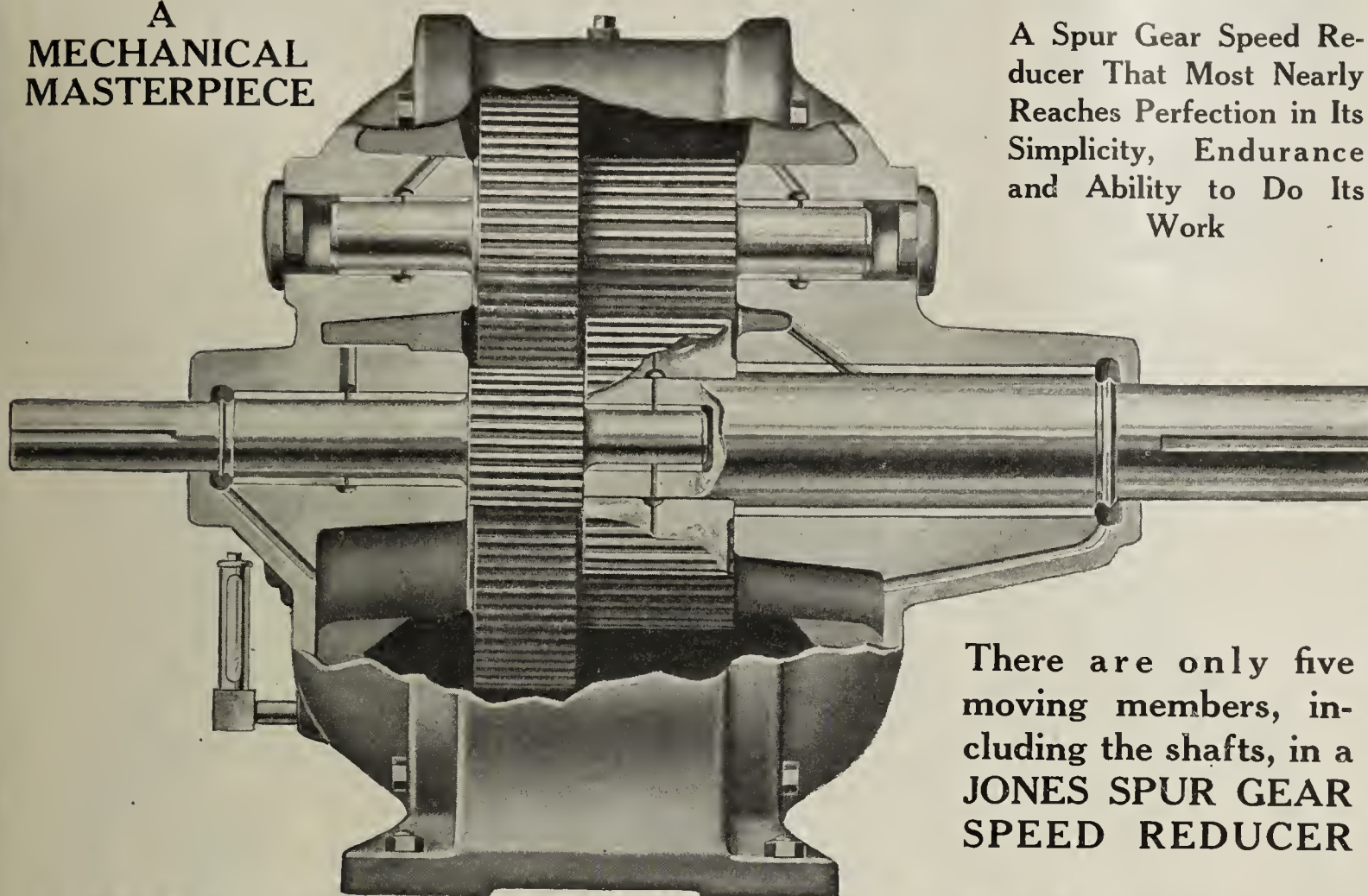
WRITE FOR CATALOG D

— Established 1906 —

THE CINCINNATI FROG & SWITCH CO.

Cincinnati, Ohio

A
MECHANICAL
MASTERPIECE



A Spur Gear Speed Reducer That Most Nearly Reaches Perfection in Its Simplicity, Endurance and Ability to Do Its Work

There are only five moving members, including the shafts, in a JONES SPUR GEAR SPEED REDUCER

JONES SPUR GEAR SPEED REDUCERS

stand alone and above all others in excellence and simplicity

And There Are Mechanical Structural Reasons to Explain It

All shafts are accurately ground to size.

The gears and pinions are not milled with rotary cutters, but are accurately generated, with stub teeth of 20° pressure angle (the recognized standard for automobile and truck transmission).

The Jones Reducer is just a plain spur gear drive with no internal gears or overhung pinions involving a complicated mounting.

The consistent use of Johansson limit gages insures absolute interchangeability of parts.

Every gear, pinion and bearing is flooded with oil at all times (and is supported at both ends in liberal bronze bushed bearings).

Sling rings on the two extended shafts keep all of the oil in the housing. The height of oil can be determined instantly by looking at the sight gage.

Every Reducer problem is given a complete engineering analysis, thus insuring the selection of a machine amply proportioned for the full duty to be performed. Let us assist you in solving your reducing problems.

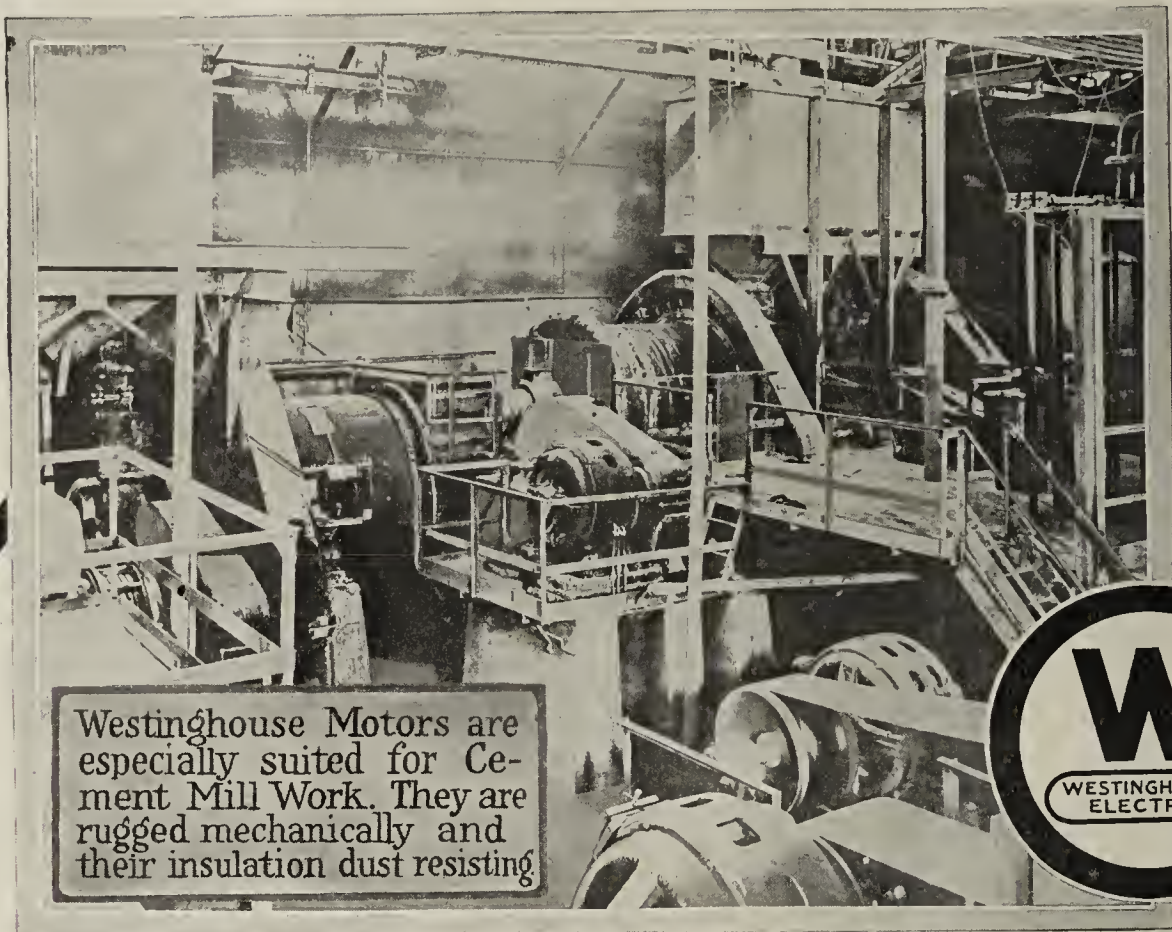
W. A. Jones Foundry & Machine Co.

ESTABLISHED 1890

4406 WEST 12TH ST., CHICAGO.

NEW YORK OFFICE: 30 CHURCH ST.

Meet New Demands with New Methods



Westinghouse Motors are especially suited for Cement Mill Work. They are rugged mechanically and their insulation dust resisting

WWESTINGHOUSE
ELECTRIC

Now that the big job across the water is completed, and delayed building activity will be resumed, will you be in a position to reap the fullest benefit from new trade conditions? Deferred plans for dams, irrigation projects and roads may now be carried to completion, and it is fair to assume that cement will enjoy an unprecedented demand.

How much of this demand you share in will be largely dependent on the capacity of your mill—which can be speeded up and made increasingly productive with

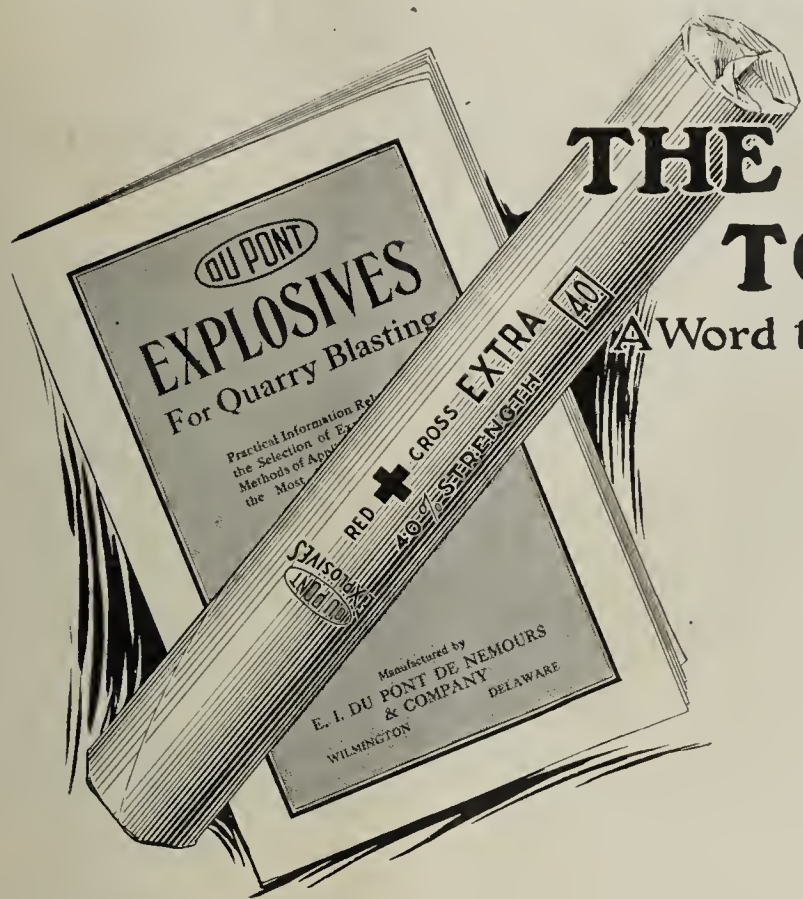
Westinghouse Electric Drive

Many cement manufacturers who have already electrified with Westinghouse Equipment, will be prepared to meet the heaviest demands on short notice. Write our nearest office. The service of Westinghouse engineers are at your disposal

Westinghouse Electric & Mfg. Co.,
East Pittsburgh, Pa.

Westinghouse

DU PONT AMERICAN INDUSTRIES



THE STICK TO STICK TO

A Word to the New Quarry Boss



YOUR predecessor used Du Pont Dynamite because he knew he could depend upon its satisfactory performance. Other dynamites might accomplish as much but the experienced blaster realized that Du Pont Explosives would give satisfaction EVERY TIME.

Therefore, in your new responsibilities it is best to "let well enough alone"—let Du Pont do the experimenting. If it were possible to produce better explosives, Du Pont would do it. Select the proper grade of Du Pont explosive for your work and then STICK TO IT.

"Explosives for Quarry Blasting" is a valuable text-book. Write for a free copy to Advertising Division,

E. I. du Pont de Nemours & Co.

Powder Makers Since 1802

Wilmington

Delaware

The Principal Du Pont Products Are:

Explosives: Industrial, Agricultural and Sporting.

Chemicals: Pyroxylin Solutions, Ethers, Bronzing Liquids, Coal Tar Distillates, Commercial Acids, Alums, Lithopone, etc.

Leather Substitutes: Fabrikoid, Rayntite Top Material, Fairfield Rubber Cloth.

Pyroxylin Plastics: Ivory, Shell and Transparent Py-ra-lin. Also Py-ra-lin Specialties.

Cleanable Collars and Cuffs.

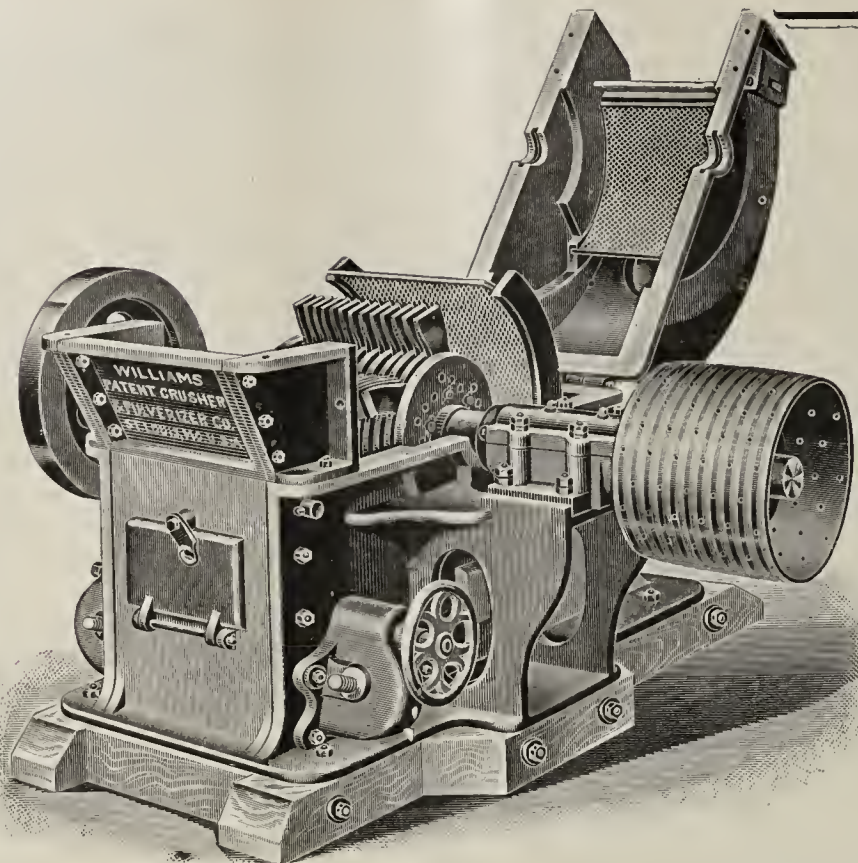
Paints, Varnishes, Pigments and Colors in Oil, Stains and Fillers, Lacquers and Enamels for Industrial and Home Uses.

Dyestuffs: Dyes, Dye Bases and Intermediates.

Plants, Warehouses and Sales Offices in principal business centers.

For information address: Advertising Division, Du Pont Co., Wilmington, Del.

DU PONT



WILLIAMS

LIMESTONE GRINDERS

Take 2 in. to 3 in. dry stone and in one operation, without outside screens or separators will produce 95% through 20-mesh material.

CAPACITIES RANGE FROM 1/4 TO 30 TONS PER HOUR

Over 5,000 Williams Mills in Daily Operation.

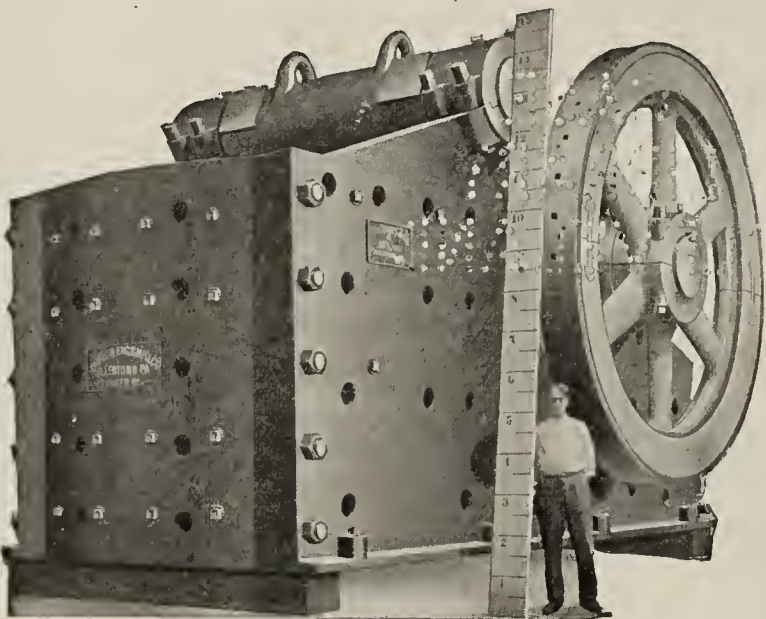
There is undoubtedly room in your plant for one of these machines, which, in the last twenty-two years have proven that they are money savers, can be depended on, and really have merit. If further information is desired, Write for Bulletin No. 17, which is brim full.

THE WILLIAMS PATENT CRUSHER & PULVERIZER COMPANY

General Sales Dept.—37 West Van Buren Street
CHICAGO

Plant
ST. LOUIS

67 Second St.
SAN FRANCISCO



Traylor 60"x86" All Steel Jaw Crusher

TRAYLOR JAW CRUSHER

Are Built in All Sizes from 7"x10" to 66"x86"

The 66"x86" is the largest crusher built.

All Traylor Jaw Crushers have cast steel water cooler pitmans.

Extra size pitman and swing jaw shafts of finest hammered steel.

Chrome steel toggle seats.

Manganese steel or chilled iron jaw plates.

TRAYLOR ENGINEERING & MANUFACTURING COMPANY

MAIN OFFICE AND WORKS: ALLENTOWN, PA., U. S. A.

NEW YORK - CHICAGO - LOS ANGELES - SPOKANE

TRAYLOR BUILT MACHINERY

A CRUSHER FOR EVERY PURPOSE

We Make

In addition to JAW CRUSHERS illustrated

The Traylor Gyratory Crusher

The last word in Gyrators.

The Traylor Crushing Rolls

They eliminate the personal equation in automatically preventing tire corrugations.

The Traylor Tube Mills

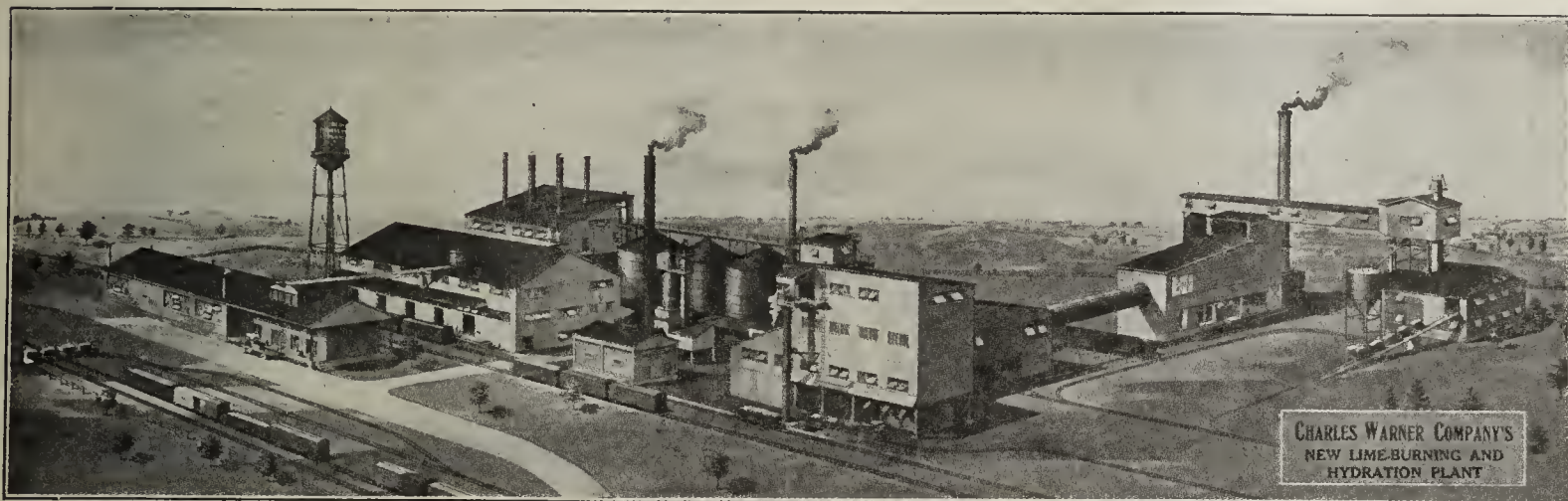
Long or short for wet or dry grinding. Have water cooled bearings of extra size. Positive automatic feed that assures maximum tonnage for minimum horse power.

The Traylor Ball Tube Mill

For reducing lumps to fines in one step.

**"THE ULTIMATE
CRUSHING EQUIPMENT"**

A MODERN LIME PLANT EQUIPPED WITH A MODERN CRUSHER



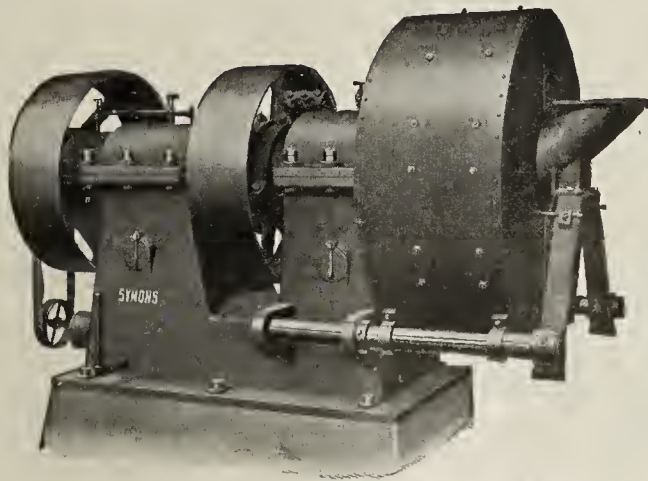
The Charles Warner Co., Wilmington, Del., recently built a new plant at Cedar Hollow, Pa., that is unique in many respects. Its outstanding features are the use of a rotary kiln for lime burning, and a new method of handling the hydrating process.

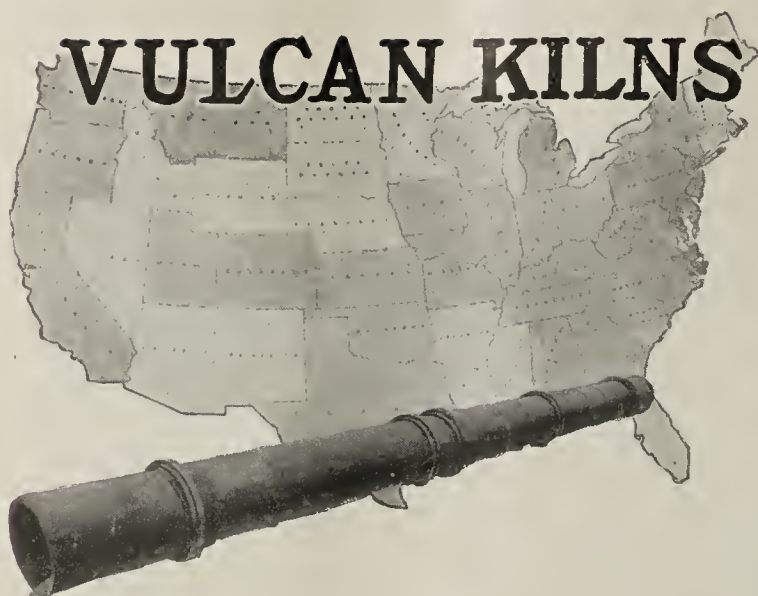
The rock in the quarry is handled by steam shovel, and it was largely to eliminate hand labor in the quarry that the rotary kilns were installed. The rock comes into the crusher house in 2-ton quarry dump cars and is dumped to a gyratory crusher, which reduces it to $2\frac{1}{2}$ " and passes it to a 48"

SYMONS DISC CRUSHER

For making that small-sized product the Symons Disc Crusher is without a rival. It is the only crusher that will take the rejections screened or unscreened from large gyratory crushers and effect a reduction to $\frac{3}{4}$ in. or less rapidly and at one operation.

Chalmers & Williams, Inc.
1445 Arnold Street
CHICAGO HEIGHTS, ILL.





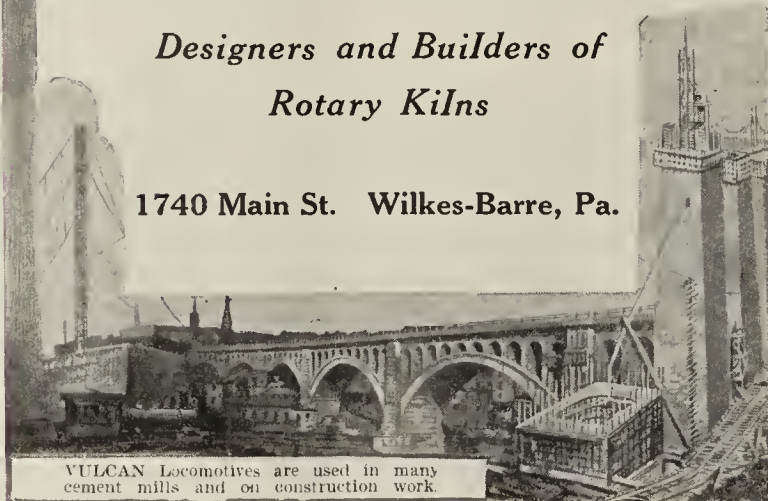
In virtually every cement producing state in the United States VULCAN Kilns are turning out thousands of barrels of cement used in building up the factories, the highways of traffic, the roads, the structures of commerce and business, the homes of countless thousands.

The real wealth of a nation lies in the permanent monuments of its enterprise. More than one thousand VULCAN Kilns are helping, by their product, to develop the wealth of this country.

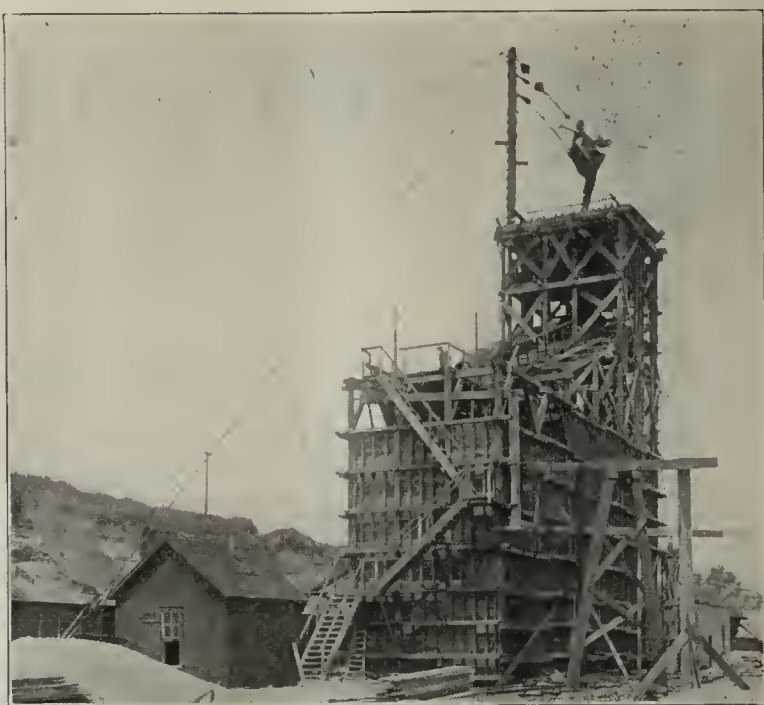
VULCAN IRON WORKS

*Designers and Builders of
Rotary Kilns*

1740 Main St. Wilkes-Barre, Pa.



VULCAN Locomotives are used in many cement mills and on construction work.



NEW WASHING AND SIZING PLANT OF
THE TECUMSEH GRAVEL CO.,
TECUMSEH, MICH.

—Where—

A 100 H.P. PRIMM OIL ENGINE

Furnishes power for the screens, bucket elevator and 5 in. centrifugal pump

Starts in less time and more easily than a Steam Engine after steam is made.

NO spark—valves—carburetor or Magneto.

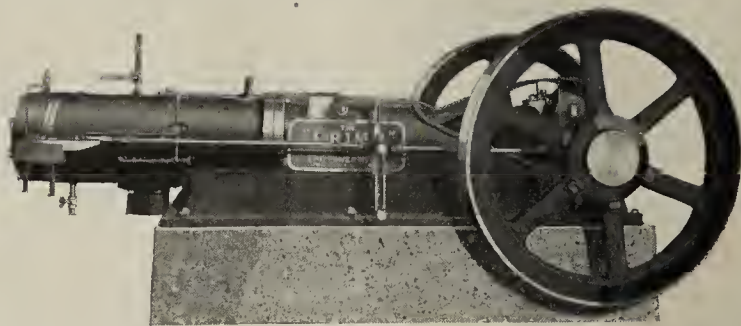
Burns crude oil or any of its by-products
Saving approximately 50%
depending on its use

Cross Head insures long life of cylinder
All working parts properly lubricated by
Splash system lubrication in crank case

The Power Mfg. Co.

13 Cheney Ave.

MARION, OHIO.



FOR TOUGH ROCK



and the very heaviest, hardest work necessary to be accomplished by a crusher, there is one powerful crusher to which the "wise" man always turns. If you will ask for our Bulletin on Crushers, you'll get some information that may be worth money to you.

Sales Offices in Principal Cities

ALLIS-CHALMERS MANUFACTURING COMPANY
Milwaukee, Wis.

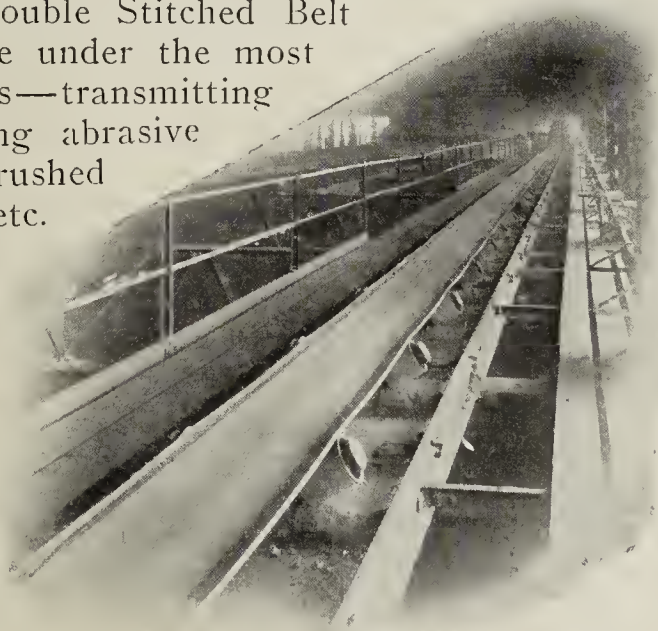
Our Name is Your Assurance.

ALLIS-CHALMERS



**This belt is built to meet
just such wearing con-
ditions as you have in
your cement plant**

In mines and mills the world over you will find Black Giant Double Stitched Belt giving record service under the most severe conditions—transmitting power and conveying abrasive materials such as crushed stone, sand, gravel, etc.



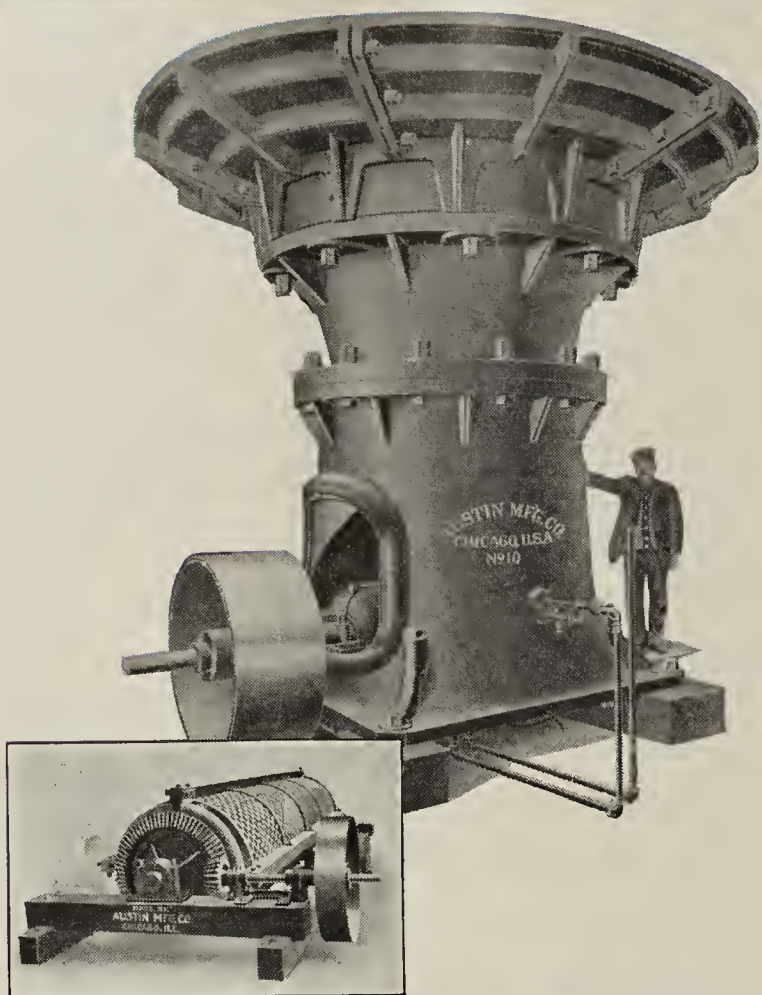
Two cement companies alone bought during 1917 over Fifty Thousand Dollars' worth of Black Giant Double Stitched Belt.

We would like an opportunity to demonstrate in your mill that this belt—because of its special construction and the compound with which it is treated—will give you better service.

McILROY BELTING & HOSE CO.

Hammond, Indiana

Black Giant Runs True and Even—No Spillage.



AUSTIN Gyratory Rock Crushers

*Reconstruction abroad means more
construction at home*

More than ever before, American contractors, builders and quarry-operators are in need of rock crushing and rock-handling equipment that can be depended upon to deliver larger outputs and that will work steadily and efficiently without interruptions and breakdowns.

Austin Gyratory Crushers—ranging in capacity from 50 to 5,000 tons per day—are guaranteed to render continuous service under the most severe operating conditions. Their convenient adjustment means an easy, speedy change in the size of the product; their large output cuts down tonnage costs because they work steadily over a wide range of material.

Write today for Catalog, describing and illustrating Austin Crushers, Elevators, Hoists, Cars, Screens, Bins, Stone Spreading Wagons and all types of Road Building and Maintenance Equipment.

During the War the United States and Allied Governments purchased

**Over 700 Austin Motor
Rollers**

More than ten times their combined purchases of all other rollers—and at higher prices

Our engineering experts will be glad to help you solve your problems and advise you as to the machinery best suited to your needs.

Austin Manufacturing Company

NEW YORK

CHICAGO

SAN FRANCISCO



Excavating gravel for Roads with Belted Hoist & Traction Engine. $\frac{3}{4}$ Cu Yd Bucket.

Speed Up Gravel Production

Maximum development of the country's resources of natural road building material is essential to the rapid completion of the vast mileage of good roads for which hundreds of millions of dollars have been appropriated by the government and the various states.

The production of gravel to meet the huge demands of the road builders is, first of all, an excavating problem.

SAUERMAN DRAGLINE CABLEWAY EXCAVATORS

are machines of superior merit for excavating sand and gravel.

No other type of machine possesses the ability to cover an area of 500 ft. radius and dig, convey, elevate and dump material in one continuous operation without help of intermediate machinery.

No other type of excavator can excavate gravel from a stream or pool and convey to bins, hopper or cars. Sauerman Dragline Cableway Excavators are as efficient in digging under water as in a dry pit.

Sauerman outfits are economical to operate. One man at the levers of a two-drum hoist controls all the operations of digging, conveying, elevating and dumping. After dumping, the bucket returns to the digging point by gravity.

The experience of our engineers in installing our cableway excavators for hundreds of sand and gravel producers and contractors is at your service if you have a gravel deposit to develop or any similar excavating problem. Write us today.

Sauerman Bros.
1139 Monadnock Block
Chicago

Mfrs. of Cableway Excavators
Power Scrapers and Cableway
Accessories



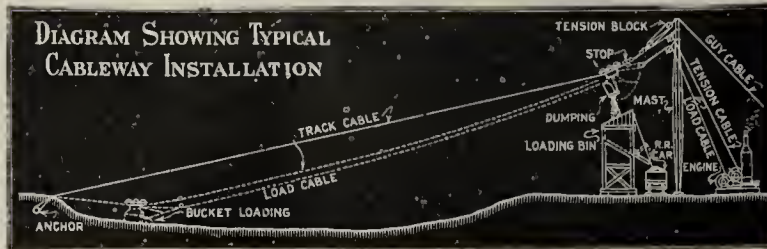
Sauerman Excavator in Commercial Sand and Gravel Plant



Road Contractor's Plant Using One of Our Machines

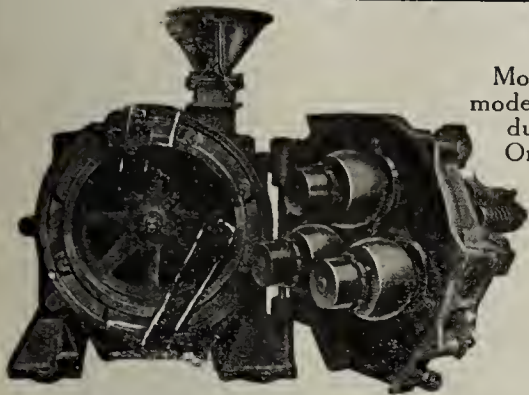


Bucket Can Be Dumped at Any Desired Point on Cableway.



STURTEVANT MILL CO.

HARRISON SQUARE . . BOSTON, MASS.



Ring-Roll Pulverizer

RING-ROLL PULVERIZERS

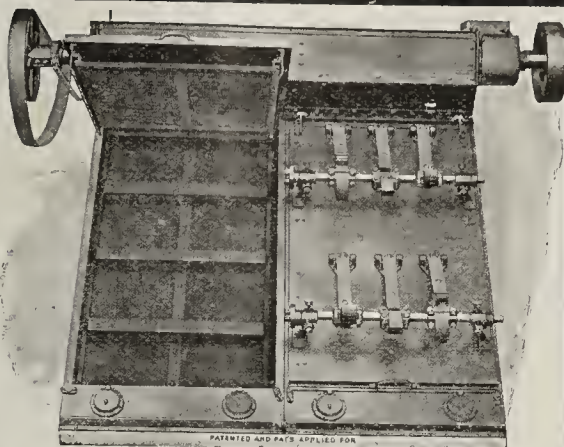
Most durable and efficient grinder for hard and moderately hard rock or ore. Used for the reduction of Cement-Clinker, Limestone, Quartz, Ores, Granite, Trap, Phosphate, Coal, etc., etc. Hundreds in use.

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NEWAYGO SUPER-SCREENS

Inclined Vibrating Screen, Unit Construction. Screens everything screenable that is reasonably dry. Produces from $\frac{1}{4}$ mesh to 180 mesh.

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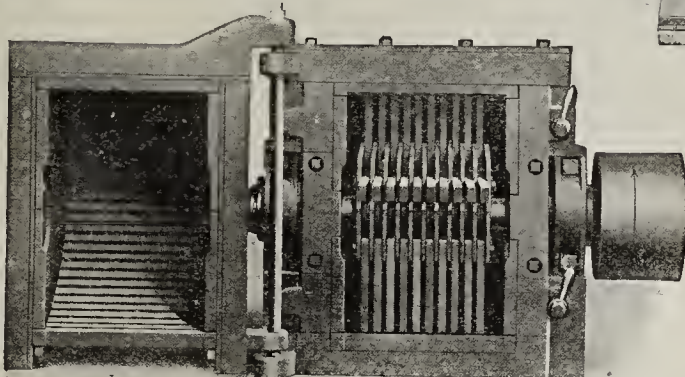


Newaygo Super-Screen

SWING-SLEDGE MILLS

The greatest producers known on Limestone, Lime, Shells, Chemicals, Talc, Clay, Chalk, Bark, Rosin, Sulphur, Coal, Salt, and many other moderately hard and soft materials. High Speed Pulverizers, crushing by a series of blows delivered at high speed against the material fed into the machine.

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Swing-Sledge Mill

WE MAKE THE
LARGEST COMPLETE

LINE OF
CRUSHING, GRINDING,
SCREENING, WEIGHING,
SACKING, ELEVATING
AND MIXING MACHINERY

IN THE WORLD

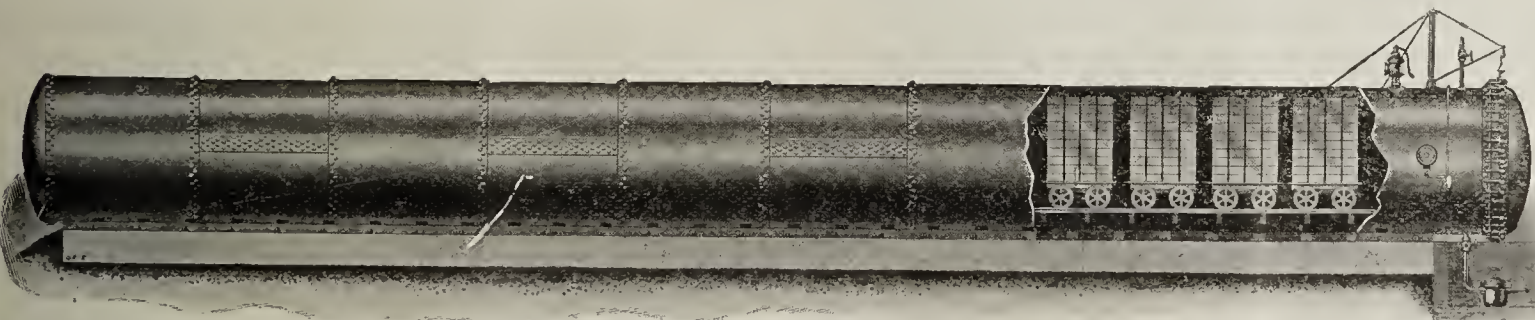
Send for Condensed Circular No. 60

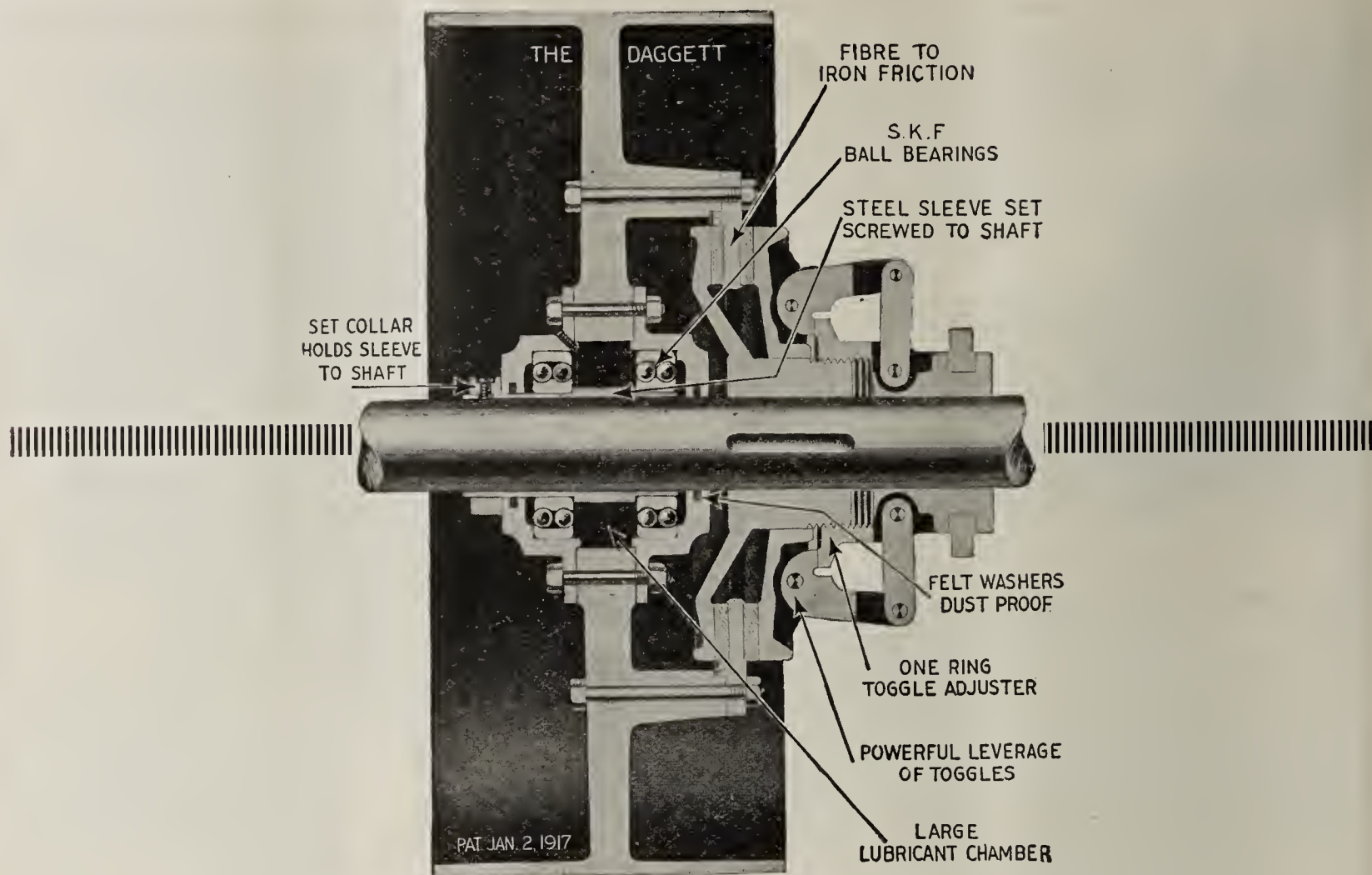
Sand Lime Brick Machinery

Our complete line of Sand Lime Brick Machinery makes it possible to secure just that machinery which is required to make your plant a success. We favor no particular type of machinery but are guided by the needs of the customer. Our wet and dry grinding mills have transformed a number of unsuccessful plants into dividend producers, while our Presses, Mixers, Hardening Cylinders and other equipment are of equal quality. We can exactly meet the demands of any manufacturer with a quality of machinery which will operate at a profit with a minimum amount of attention and expense.

Correspondence solicited

The American Clay Machinery Co.
WILLOUGHBY, OHIO





A COMPLETE LINE OF Power Transmitting Appliances

Present day conditions demand that every piece of machinery be fitted to its job—that there be no wastage of money through inefficient methods of transmitting power.

The CHICAGO Line

embraces Power Transmitting Equipment to meet every possible need. We carry in stock Wood and Steel Pulleys, Ball and Roller Bearing Drop Hangers, Ball and Roller Bearing Post Hangers, Ball and Roller Bearing Pillow Blocks, Collars, Couplings, etc.

OUR S-K-F BALL BEARING FRICTION CLUTCH PULLEY

(illustrated above) is the finest mechanism of its type on the market. Shipped on short notice.

It will run at any speed, eliminating countershafts; it will save power, save belts and save lubricants. Is simple in construction, requires less space on the shaft than any ordinary clutch and can be installed by the average shop mechanic. It is guaranteed dust proof and the lubricant chamber requires refilling but 2 to 4 times a year, according to operating conditions.

We also keep in stock a complete line of Oneida Steel Pulleys and can make immediate delivery.

Write us for Prices and Catalogues

CHICAGO PULLEY & SHAFTING CO.
40 S. CLINTON ST. CHICAGO



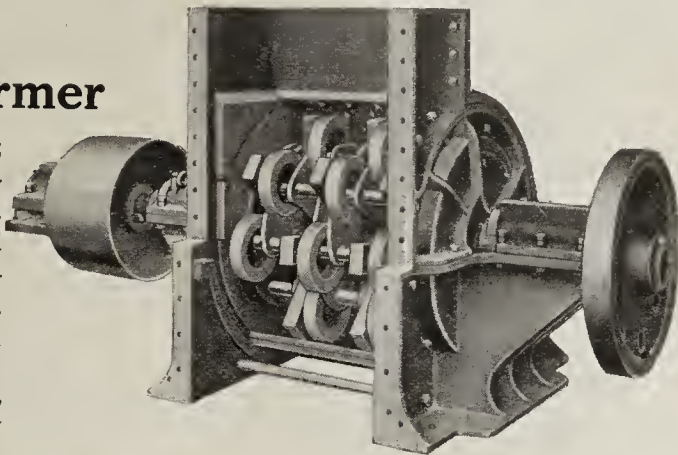
AMERICAN

Ring Pulverizers

are earning enormous profits for their users. The plant here shown paid five times its cost in profits in five months running. This is not an isolated instance. Many others have done equally well or better in producing

Limestone for the Farmer

The profits are large; the market far bigger than the supply. Install a guaranteed machine—An American Ring Pulverizer.



It's guaranteed. Cost of production is but 15 to 30 cents per ton when an American is used.

Furthermore, we guarantee our estimates of power consumption, production, wear and tear, upkeep, etc., before making the installation. You take no chances.

Write for prices and plans to the

AMERICAN PULVERIZER CO.

Corner 18th and Austin Streets

ST. LOUIS, MISSOURI

"We Crush Everything—Why Can't You Do It?"

THE SCOOP CONVEYOR



Saves 6 to 10 Men
Loading or Unloading
COAL, COKE, ASHES
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OVER 1000 USERS
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Put Your Excavating and Unloading
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Ask for BULLETIN 1015 Showing a Variety of Uses



Steam, Gasoline or Electric Power
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WHITE SAND

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Facing Concrete Blocks, Ornamental Concrete
Stone, Hard Plaster, Finishing, Exterior Plas-
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Prices, Freight Rates and Samples on Application.

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WEBER REINFORCED CONCRETE CHIMNEYS

Coniform and Cylindrical Types

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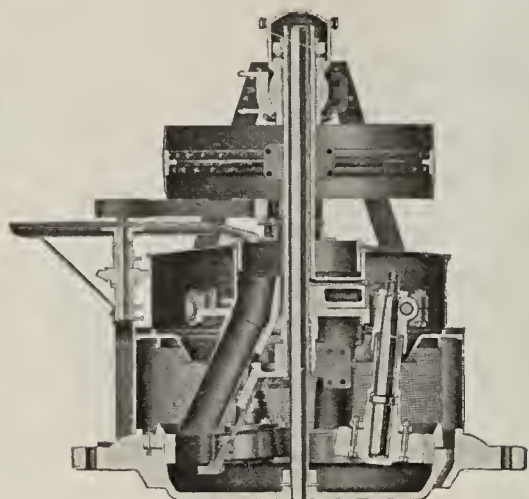
The Weber Chimney Company

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The Wonderful Performances of the Bradley Hercules Mill

AS A preliminary pulverizer of cement rock, limestone and clinker, has demanded investigation of its merits. Most of the progressive cement manufacturers are either buying or investigating this machine. It is surprising to know how many of these mills are in successful operation and more surprising to note its tremendous output, extreme fineness, low horse-power consumption and exceptionally low maintenance cost. Why not let us send list of installations, or one of our engineers, to show you how much more efficient this mill is than your present preliminary machines?



This mill has taken its place as the most economical preliminary machine ever used in the cement or agricultural limestone plant.

Let us give you complete data on its performance for the last five years—it's yours for the asking.

Twenty-two mills sold without advertising—a record unequalled in the cement industry.

BRADLEY PULVERIZER CO.

BOSTON

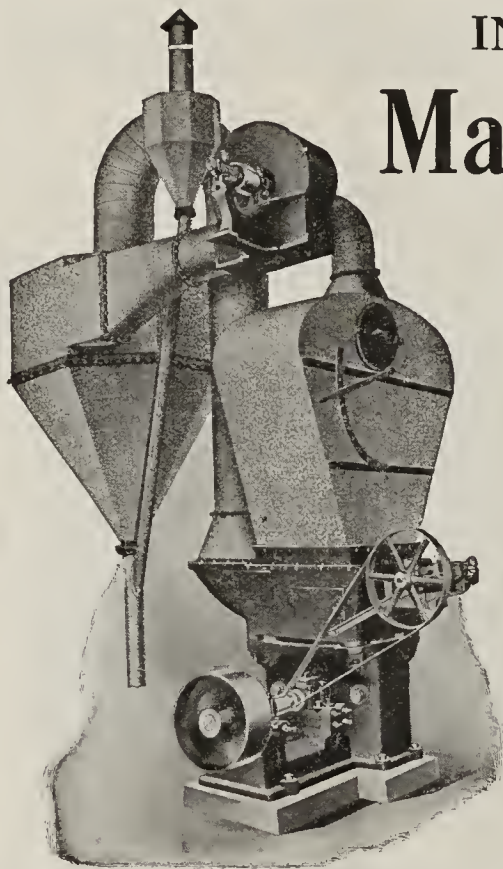
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Works: ALLENTOWN, PA.

Complete Grinding IN ONE Machine



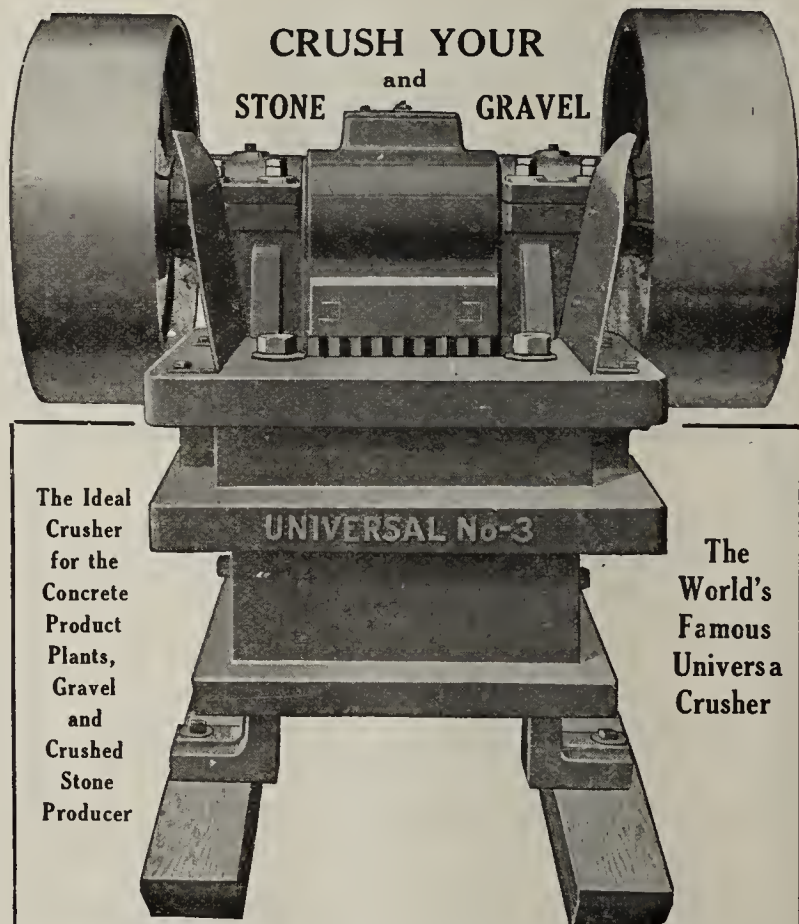
In successful use
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Cement, Clinker,
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The Ideal
Crusher
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The
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**We Build Crushers from 5 Tons to 300 Tons
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Instantly adjusted to produce size required from
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UNIVERSAL CRUSHER COMPANY
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Editorial

Direct Method of Handling Aggregates

A very satisfactory method of handling material for concrete highway construction has been devised by the Harrison Engineering & Construction Co. of Buffalo, N. Y., who have a contract for some 22 miles of paving in McDowell County, West Va.

The contractor is operating fleets of five two-ton trucks. The bodies of these trucks are equipped with an end dumping device, and lately have been equipped with three lateral partitions, making four separate compartments each containing one two-bag batch of 1:2:4 mixture. Aggregates are received from a railroad which parallels the highway under construction. Sidings are available so the haul to the mixer is seldom more than one and a half miles, and constantly lessening as the mixer approaches. At these sidings an unloader is used to handle the stone which is received in hopper cars. The unloader consists of an electrically operated bucket elevator from a pit under the rails to a storage bin having a capacity of fifteen yards. The bin is installed at a height sufficient to allow a truck to run along side and receive its charge of stone. The stone is measured on the truck by a stripe painted along the body.

The sand is discharged from the cars in stock piles from which it is shovelled by hand into a small compartment car, having four hinged measuring boxes at a height convenient to discharge into the four compartments of the truck. The car operates on a narrow gauge track, which is easily moved as the pile changes its shape.

The cement storage is also at the siding and when operations were first started, two bags of cement were placed in each compartment after the stone and sand had been deposited. This proved unsatisfactory, however, as the wind would blow the cement away and it also sifted from one compartment to the other. We are now using a truck, and three men, including the truck operator, are able to haul and place the cement at the mixer.

This method of handling the aggregates saves labor. The records show an average saving in time of 30 minutes to every mile trip. The stone from the car to the mixer drum is handled by one man in the car to keep stone to the hopper, one mechanic to look after the motor and conveyor, two men to operate the bin gates and level the stone in the trucks. The sand is shovelled into the measuring boxes by four laborers and the instant the truck comes along side the boxes are tripped by these men.

When the truck arrives near the mixer it is turned and backed to the mixer hopper. There the truck body is elevated and each of the four batches is deposited in the hopper. In this operation, a boy mounts the truck body and unfastens the partitions as the batches are needed. Two men from the grading gang step back to see that none of the material spills on the grade. If this does happen they place it in the hopper and give the engineer the signal.

The advantages of this method are: A measured batch of aggregate, no waste of material on the subgrade, no foreign material in the stone and a very little in the sand, fresh cement from the storehouse, and the saving in labor of eight shovelers and four wheelers on the stone and two wheelers on the sand.

Cement Paint

We are frequently asked how to apply Portland cement as a paint or wash and we always advise against the use of Portland cement, either gray or white, for this purpose.

In this form it will not successfully bond to old or new concrete, nor successfully "stick" to wood, brick, stone or tile for any period of time.

Portland cement requires the addition of water to crystallize or make it hard, and where it is used as a paint or wash the surface upon which it is applied, being always more or less porous, immediately absorbs the water from the mixture, with the result that the water of crystallization is absorbed, the thin coat of cement checks and cracks can be rubbed or finally becomes "chalky," and falls off. The only form in which a cement wash can be used is on fresh concrete, where, immediately after the forms are removed, it is applied and rubbed in with a carborundum stone so that it becomes part of the mass.

Dust Respirators

Protection from dust and liquid mists is obtained by the use of a simple dust respirator, which removes these particles by means of a filter of moist sponge, cotton or wool pad, porous paper or even a very fine mesh metallic gauze. The respirator may enclose the mouth and nose only, or it may be combined with a face mask containing eye pieces if the eye must also be protected. The simple "pig snout" respirator containing a moist sponge has been on the market for years. It is highly uncomfortable to wear, rather insufficient for removing fine dust and most workmen prefer to tie a large handkerchief over their nose and mouth. Some improvement has been made in recent years, but on the whole a really efficient and comfortable dust respirator that workmen will wear continuously is yet to be devised. On account of the urgent need of such a device for safeguarding the health of workmen in the mining, cement, lime and metallurgical industries, the Bureau of Mines, Department of the Interior, Washington, D. C., has undertaken a study of dust respirators with a view to seeing that as satisfactory a model as possible is available to these industries.

Castalia Cement Plant

With improvements and repairs completed, the Castalia Portland Cement Company's mill at Castalia, Ohio, is now operating to full capacity, in fact, on a larger scale than at any time since last June. This gives employment to many men.

Cement Prices Going Up, State Probers Told

Cement prices will advance 10 or 15 per cent this year, according to Albert Y. Gowen, vice-president of the Lehigh Portland Cement Company, who testified recently before the Illinois legislative investigating committee.

This company has thirteen plants in the United States, with head offices at Allentown, Pa. It has an invested capital of \$24,488,000. Last year the company made a little under 6 per cent on this capital. Dividends were 4 per cent.

In 1913, Gowen testified, the average cost of making cement was .62 a barrel. The average net selling price was .82. In 1918 the cost was \$1.44 a barrel and the net price received \$1.62.

Mr. Gowen said there was no chance of the 1918 price being lowered, but that in order to get a fair return on invested capital the company should ask more.

Chairman Dailey of the committee read from a report made last January to Governor Lowden by a committee of engineers. This report went into the details of the cost of manufacturing cement in Illinois. The figure arrived at by the engineers was \$1.25 a barrel.

"That is the difference between theory and actual practice," said Mr. Gowen. No two engineers in the country are able to tell what the cost of manufacturing cement is. If this plant could be made to run 365 days a year at maximum capacity and labor and coal should come down, then the cost might approximate \$1.25. But we have not been able to get it down there.

"I think the cost of manufacture this year will be about \$1.50 a barrel."

Chairman Dailey said:

"The state has great improvements to make. Contracts are waiting. With the plants running at full capacity, wages not lowered, fuel remaining about the same, is there any assurance you can give the public promise of a lower price for cement this year?"

"The actual cost is based on labor and fuel and overhead expenses," replied Gowen. "The cost of \$1.45 a barrel last year will not be reduced. I think it will be advanced. I think we should have 10 per cent dividends, 5 per cent for depreciation, and 5 per cent surplus on \$24,000,000."

Analysis and Tests of Rigidly Connected Reinforced Concrete Frames

Rigidly connected frames are frequently used in reinforced concrete construction. Since about 1905 they have been extensively used in continental Europe, and there is a tendency in America to use them for buildings and bridges. The field of the application of rigid frames is almost unlimited, for most reinforced concrete structures are composed of elements of rigid frames. Every building construction of reinforced concrete may be considered as a rigidly connected frame, for columns, girders, beams and slabs are all rigidly connected with each other, although the effect of this condition is not fully considered in the design. Bridges, trestles and viaducts are also in the field of the rigid frame. Likewise parts of culverts, sewers, subway constructions, reservoirs and water tanks are examples of the rigidly connected frame.

The reinforced concrete frame is advantageous in

that it is economical and permits effective designs. Notwithstanding the importance of the frame in construction, practical formulas to determine exactly the stresses as they occur in a rigidly connected reinforced concrete frame are not generally available.

A series of tests has been conducted by the Engineering Experiment Station of the University of Illinois to obtain experimental information concerning the stresses in the reinforcement and in the concrete, the continuity of the composing members of a frame, the location of sections of critical stress, the reliability of a reinforced concrete frame and the applicability of the theoretical formulas in the design of frames. Formulas for moments and other indeterminate quantities for several types of indeterminate structures have been derived. To test practically the reliability of these formulas for reinforced concrete structures, eight test frames were designed according to the formulas found by the analyses, and the deformations produced in the various parts of the members by the test loads were measured. The specimens were made in November and December, 1913, and January, 1914, and were tested in January, February and March, 1914. The following cases have been analyzed for vertical load: (1) single story, single span; (2) single story, three spans; (3) trestle bent with tie, single span; (4) building frame with several stories and several spans; and (5) bridge trestle. For horizontal load the following cases have been analyzed: (1) single story, single span; (2) octagonal reservoir or tank; and (3) rectangular reservoir or tank.

The formulas found from the analyses and graphs showing the main stresses that were observed at the principal loads are published in Bulletin 107 entitled "Analysis and Tests of Rigidly Connected Reinforced Concrete Frames" by Mikishi Abe under the direct charge of Professor Arthur N. Talbot, Department of Theoretical and Applied Mechanics, University of Illinois. Copies may be had without charge by addressing the Engineering Experiment Station, Urbana, Illinois.

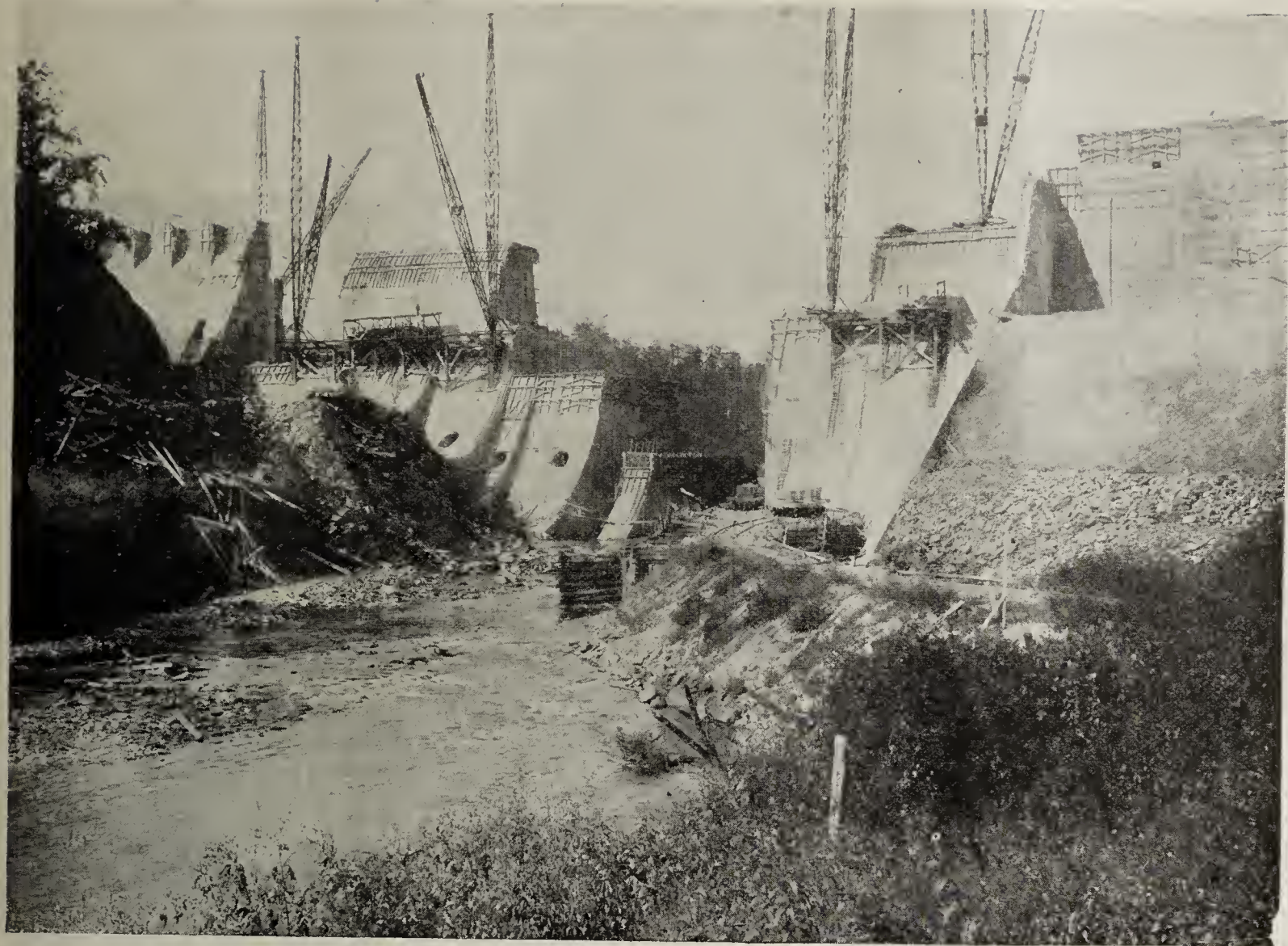
A New Book on "Concrete Stone Manufacture"

In 1915 Mr. Harvey Whipple, managing editor of Concrete, Detroit, Mich., published a valuable treatise on "Concrete Stone Manufacture." At that time it was the first and only volume that had appeared on the subject and was read with eagerness by those who wished to inform themselves upon a subject that was destined to become a factor in the building industrial world.

Since 1915 this author has gathered much new data, made possible from practical experience and the development of the industry. The book, therefore, has just been completely revised and considerably enlarged and the new edition is just being put on the market.

The new volume covers more than 300 pages, with nearly 200 illustrations, and supplies as near a complete education on this kind of work as one can possibly get from a book. It includes chapters on the selection and combination of materials; the layout and equipment of plants; moulding and curing; surface treatment; shop records and cost keeping, and closes with some very pertinent suggestions on business methods and plans for selling the product.

The author has set out with a determination to give real value to his readers and has succeeded remarkably well. The book is bound in blue cloth and sells at only \$1.50. Sent on receipt of price by Cement & Engineering News, 22 Quincy St., Chicago, Ill.



Section of Dam of Southern Power Co. for 30,000 Horse-Power Hydro-Electric Development at Bridgewater, N. C.

Great Hydroelectric Development in North Carolina

The latest development of water-power on the Catawba River is the construction of a mammoth 30,000 horse-power hydro electric plant at Bridgewater, N. C. This plant will probably be completed and put into operation by July 1. Its purpose is to impound the waters of three streams that intersect near the town of Bridgewater, N. C., including the Catawba River, Linville River and Paddy Creek, a tributary of Linville River. With the completion of this plant, the total number of water-power developments supplying the Southern Power Co.'s system located on the Catawba River will be seven, with a total development of 208,600 horse-power.

The Bridgewater plant is the maximum of the seven and is the biggest plant of its kind anywhere in this section of the South. The Bridgewater plant is the furthest up toward the headwaters of the Catawba River of any of the developments. The location of the land, which consists of three mountain valleys lying along the Catawba River, the Linville River and the valley between these two lying along Paddy Creek, makes it an ideal plant of its kind. More than 6500 acres of land will be subject to overflow, or an area of 10 square miles. The lake formed when the dams have been completed will be the largest in the state, and will be approximately twelve times the size of Lake Toxaway.

In constructing the plant three dams have been built, one each across the three streams. This was done on account of the topography of the land, it being much

more practical to build three dams than to construct one across the Catawba River lower down. The dam across the Catawba River in midstream is of solid masonry, 125 feet high and supplemented at each end with an immense earth dam 600 feet thick and containing 2,000,000 cubic yards of earth in its construction. The masonry dam is now about 90 per cent complete, while the earth dam is only 75 per cent complete.

Across Paddy Creek, a distance of about two miles from the Catawba River dam, another dam has been built, which resembles one of the small mountains, located in that section. It is 165 feet high and 900 feet thick, and contains 1,600,000 cubic yards of earth. This dam is complete.

Another dam of similar huge dimensions, being 165 feet high and of proportionate thickness, is being built across Linville River, about one mile distant from the Paddy Creek dam. This dam is about three-fourths complete. It will consist, when complete, of about 1,300,000 cubic yards of earth.

When these three dams are complete it will constitute one of the greatest of water-storage plants, and with this plant in operation the outlook for the other plans along the Catawba River will be much brighter, as there will not likely be any suffering on account of closing down for lack of water supply, and thus the mills and other industries getting their power from the Southern Power Co. system will be largely benefited when the Bridgewater plant has been completed. The three valleys along the three streams will make an immense reservoir for holding the water back for use when it is needed.

The power-house is located on the Linville River,

just below the Linville River dam, and a tunnel 920 feet long and 20 feet in diameter has been cut through a mountain which carries the water from the reservoir to the power-house and empties through an immense steel penstock. The power-house is complete, and has all machinery installed ready for operation. It is equipped with two generators of 15,000 horse-power each.

The work on this plant was started in July, 1916, and has been kept up steadily ever since. About 1500 people have been employed in the construction, and 20 steam shovels and 60 locomotives have been in service during that time.

The name of the corporation constructing this plant is the Western Carolina Power Co., and the electricity generated will be used by the Southern Power Co., in its system throughout the Piedmont section.

The general contractors for the development were the Hardway Contracting Co. of Columbus, Ga.; Allis-Chalmers Manufacturing Co. of Milwaukee, Wis., furnished the electrical generators.

Williams Pulverizer Open Exhibit Room

A permanent exhibit of its line of crushers has been installed by the Williams Patent Crusher and Pulverizer Company in connection with its sales office in Chicago.

This exhibit occupies an entire room in the office suite, and inasmuch as the working parts of all machines are open to view, so that their action can be carefully investigated, the place will prove a very attractive one for men who are expecting to buy new crushing and pulverizing units.

In announcing the opening of this room, M. J. Williams, general sales agent, says:

"March 15, 1901, just 18 years ago, we established sales offices in Chicago. Since that time we have sold from these offices several million dollars worth of crushers, grinders and shredders, for use on many hundred different materials, in almost every country of the world.

"During the past five years we have had the pleasure of having customers and prospective customers visit us from all parts of the world. As our works are at St. Louis, we found it quite difficult to persuade the prospective buyers to make the side trip to that place, especially those en route from San Francisco to New York. Therefore, in our opinion, it was the logical move to establish in Chicago an exhibit room where we could properly display our line of mills.

"We have now established such exhibit room and believe that this display will be approved by those interested in our grinding mills. We extend an invitation to those contemplating the purchase of crushers, grinders and shredders, to view these machines and talk with us before purchasing. We can show you the mill you are interested in in full size and not models or pictures.

"To our customers who have already purchased Williams mills, we extend a hearty invitation to drop in and look over this display while in Chicago or in the vicinity of our headquarters, for it will interest you to learn all you can about the internal construction of your Williams mill.

"Do not fear to encroach on our time. We shall always be glad to see you and to show and tell you all we can about the Williams mill."

New Book—"Sewage Disposal"

"Sewage Disposal" is the title of a new book (second edition rewritten) by Leonard P. Kinnicutt, late director, Department of Chemistry, and Professor of Sanitary Chemistry in the Worcester Polytechnic Institute; C. E. A. Winslow, Professor of Public Health in the Yale School of Medicine, and Curator of Public Health in the American Museum of Natural History, New York, and R. Winthrop Pratt, Consulting Engineer, member American Society of Civil Engineers, just issued by John Wiley & Sons. It is profusely illustrated and contains 547 pages. Price, \$4.00. Sent on receipt of price by Cement and Engineering News, 672 Transportation Bldg., Chicago, Ill. The table of contents follows:

The Sanitary Demand for Sewerage and Sewage Disposal. Composition of Sewage. Disposal of Sewage by Dilution. Screening and Straining of Sewage. Preliminary Treatment of Sewage by Sedimentation. Preliminary Treatment of Sewage by Chemical Precipitation. Preliminary Treatment of Sewage by the Septic Process. Preliminary Treatment of Sewage in Two-Story Tanks. Disposal of Sewage by Broad Irrigation or Sewage Farming. Disposal of Sewage by Intermittent Filtration Through Sand. Treatment of Sewage in Contact Beds. Treatment of Sewage in Trickling or Percolating Beds. Treatment of Sewage by the Activated Sludge Process. The Disposal of Sewage Sludge. Disinfection of Sewage and Sewage Effluents. Some General Considerations in Regard to the Design and Operation of Sewage Treatment Plants. Disposal of Sewage and Excretal Wastes in the Absence of a Sewerage System. Methods of Testing Sewage and Sewage Effluents.

A Successful Mobile Sand and Gravel Enterprise

During May of 1916 the Mobile & Gulf Navigation Co., Inc., was organized and began operations with a capital of \$10,000. The business increased to such an extent that the capital was increased to \$100,000, at which time this company took over all the business equipment of the Southern Fuel & Material Co. The officers are Paul E. Chalifoux, president; R. H. Radcliff, vice-president and treasurer, and S. L. LaVergy, secretary. Mr. Chalifoux is interested in several large enterprises in Birmingham and saw the wonderful possibilities of a company of this kind, which he established in Mobile, Ala., where its home office is located. They own three schooners, four tugboats, two suction dredges for sand and gravel, two floating dredges for timber, and 16 river barges for handling sand, lumber and timber. They operate a schooner between Tampa and Mobile and other points, and have a capacity of sand and gravel amounting to 1,000 yards per day. Mr. Chalifoux is also president of the Kirkpatrick Lumber and Timber Company and the Kirkpatrick Sand and Gravel Company, Birmingham, Ala., the largest producers of sand and gravel in the South. By his close association with the lumber company they will be enabled to handle lumber from Alabama river points most expeditiously, which will offer an outlet for their lumber business. They expect to load lumber for all points nearby, as well as foreign points. This company has been very successful since its inception.

The pouring of cement for the first concrete barge at the Holler, Davis & Flood shipyards, Fort Edward, N. Y., started on October 20th, and continued for about thirty-six hours. Four barges are already under construction with orders for many more.

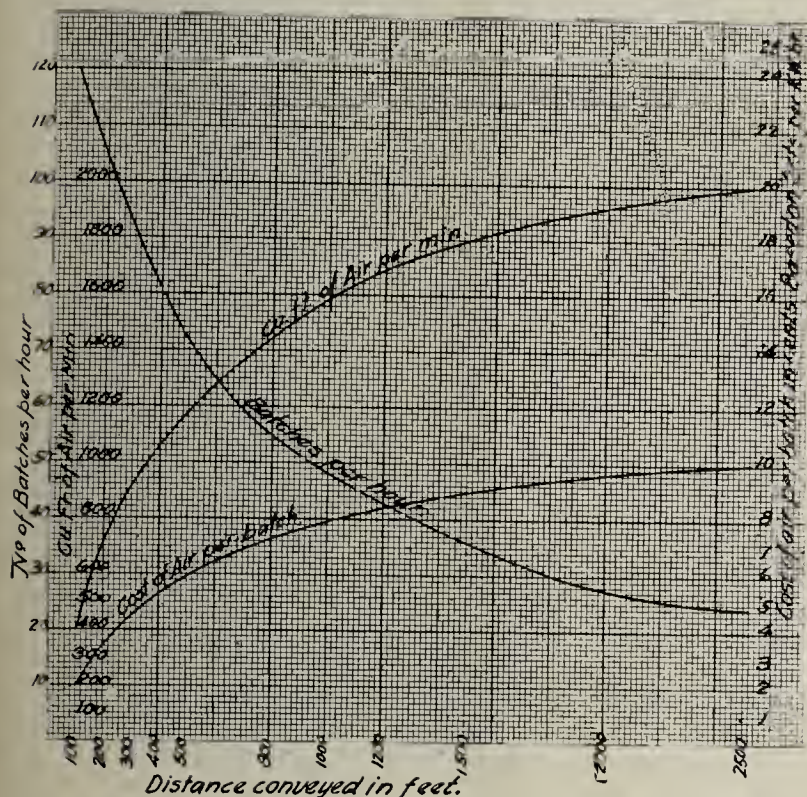
Pneumatic Method of Concreting

By H. B. Kirkland*

The pneumatic method of mixing, conveying and placing concrete is adapted for heavy, difficult concrete work, using ordinary ingredients with aggregates up to 4 or 4½ inches in diameter.

Briefly, it consists simply in blowing batches of concrete through a pipe from a central point of supplies to their place in the concrete forms. The materials for a batch of concrete (½ cu. yd.) are proportioned in a measuring device and dropped into the pneumatic mixer without previous mixture.

The plant for pneumatic mixing and placing consists of (1) a mixer, (2) a pipe conveying system, and (3) a compressed air plant.



Curve of Capacity and Air Required at Distances to 2,500 Feet

The Mixer

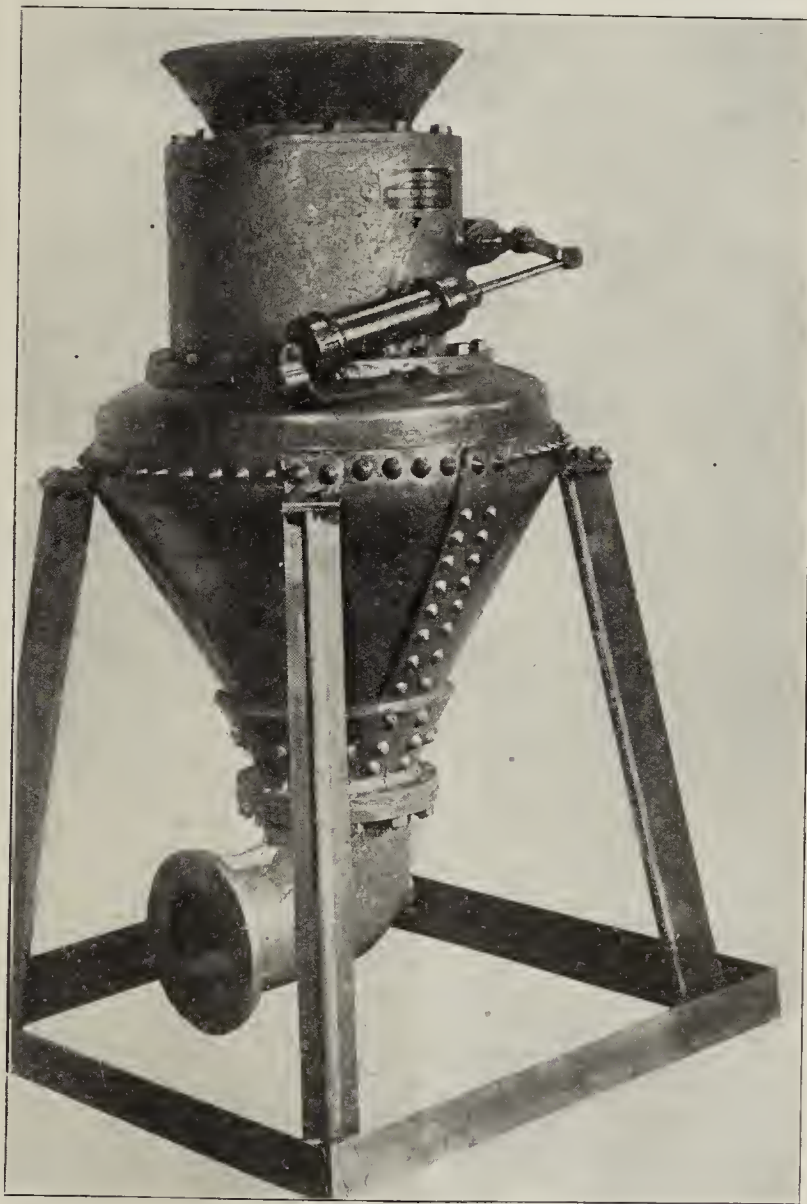
The mixer consists of a steel shell having the shape of an inverted cone surmounted by a cast steel cylinder in which the door operates. The door is operated by a small air piston which closes the flap door. The door is opened by releasing the air in the cylinder, allowing the door to drop open by its weight. At the bottom of the inverted cone chamber is a 90° elbow which forms the connection to the discharge pipe. The door and piston is the only moving part of the mixer and the inside contains no mechanical mixing apparatus and is entirely smooth and free from obstructions. The main air jet is located at the heel of the bottom elbow of the mixer. This jet is the main means of conveying and mixing the concrete. It is supplemented by air jets located at top of the mixer. The main air jet is directed into the center of the discharge pipe, where it catches the material as it falls from the cone-shaped hopper above. The upper air jets create a pressure from above the batch, forcing it downward into the discharge pipe, where it is caught by the main jet. To admit air to the mixer, two valves are used, one opened. This is followed by opening the valve to the upper air jets. Many operators vary this method, but the effect of this sequence of control is to start the

batch forward at the bottom of the machine, detaching successive portions of batch at the tip of the cone. The materials in the mixer flow downward in the same manner that sand flows from the upper chamber of an hour-glass, but the speed of the flow is accelerated by the air pressure.

In operating, after the batch containing cement, aggregate and water is placed in the mixer, the door is closed and the main jet is located on the air supply line leading to the lower jet, and the other on the line leading to the upper jets placed above the level of the batch.

Conveying Pipe

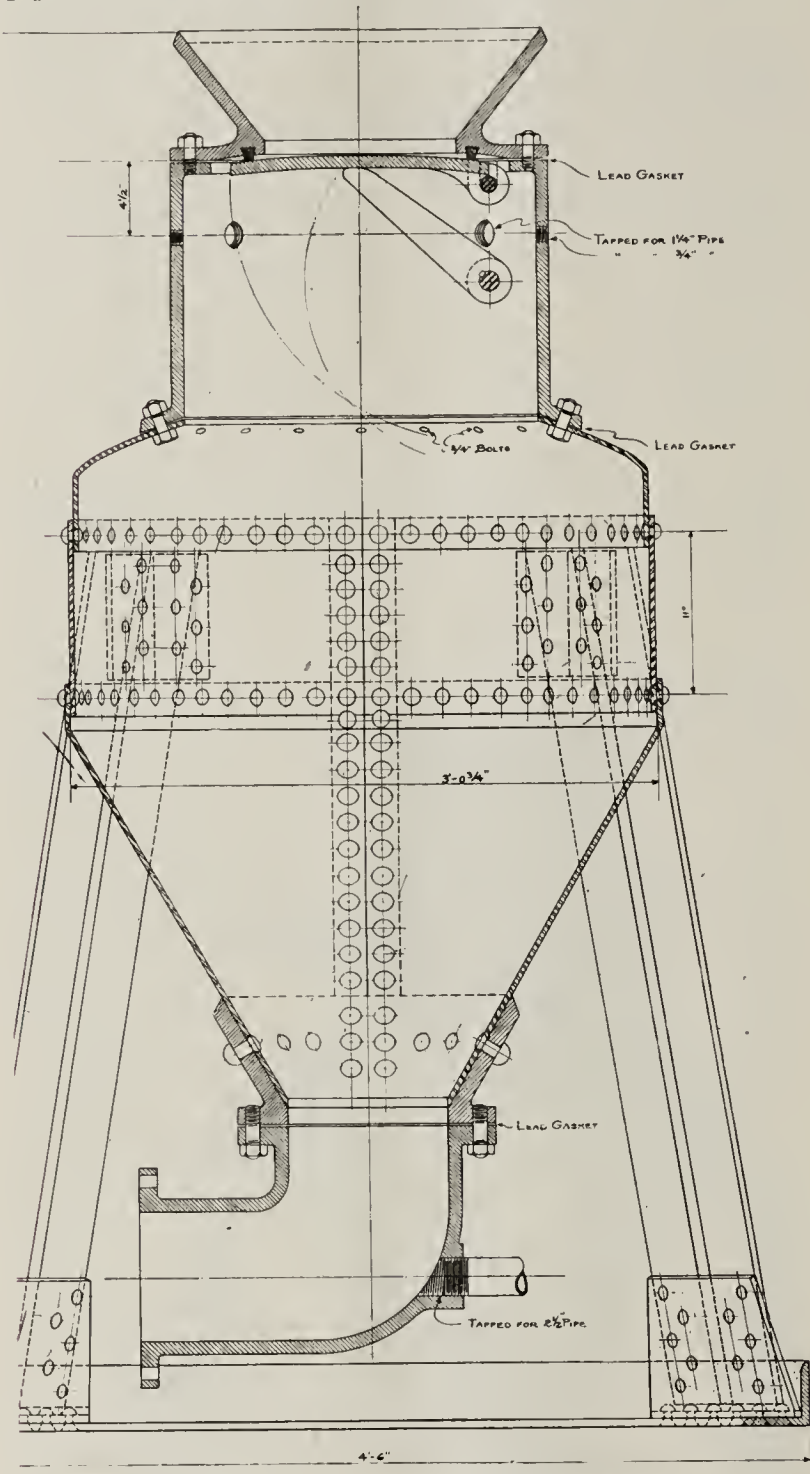
The conveying pipe consists of any standard smooth steel pipe with joints made with bolted flanges or any type most easily and rapidly handled in making connections. The most rapid wear on pipe occurs at the joints where there is apt to be a slight irregularity or a shoulder. Threaded pipe is also thinner where the threads are cut and, of course, wears through there first. For this reason we have used several types of joints and the Van Stone joint is about the best. This is out of the question now—in war times—however, on account of the cost of anything not of standard make, so we have found it cheaper to use standard pipe with bolted flanges screwed on. For making deflections of the pipe line, cast elbows are used. An ordinary cast iron elbow will last sometimes less than a day, but a case-hardened steel elbow will usually



Pneumatic Concrete Mixer

*President and Chief Engineer, Concrete Mixing and Placing Co., Chicago. Excerpt proceedings Western Society of Engineers.

last a few weeks. The best elbow found is a cast manganese, which will almost outlast the pipe itself. We have made these els in 45° with a thickness of $\frac{5}{8}$ -in. on the inner curve and $\frac{7}{8}$ -in. thickness on the outer curve. This gives a weight of about 220 lb. for an 8-in. elbow and we have, therefore, not made them longer than 45° . The radius of the el is 3-ft. minimum, as a shorter radius is too sharp a turn and causes plugs in the line. Shorter radius els may be used, however, if used at the discharge end of the pipe. We have also used a split elbow at 90° for 6-in. pipe. This el is split lengthwise so that the outer half



Section of $\frac{1}{2}$ -Yard Pneumatic Mixer

of the curve which usually wears rapidly may be replaced.

A means of deflecting or guiding the discharge of concrete in the forms consists of a series of slightly tapered pipes, fitting together like stovepipe. Two or three sections of this light pipe about 3 or 4 ft. long are all that are needed in a tunnel form for diverting the discharge from one side wall to the other and for guiding the concrete discharge around points of rock projecting from the roof. Where the tunnel is very wide, however, as in a double track railroad tunnel, we have used a "Y" branch in the line, thus separating

the line into two lines of pipe entering the tunnel form. A slide valve or gate is placed in the "Y" for diverting the batches through one line or the other.

Compressed Air Plant.

A suitable type of compressor and the one usually employed in a straight line, 1 or 2-stage machine compressing 80 to 125 lb. The motive power may be steam, oil or electricity, as is most economical under the conditions prevailing. When possible, it is desirable to locate the plant near the mixer, but it is necessary to provide air storage close to the mixer, sufficient at least to store enough air to discharge a batch of concrete at the maximum distance required. This storage should be at least 100-ft. capacity, with 30 cu. ft. capacity added for each 100 ft. of pipe line. There should be additional storage at the compressor if the mixer is located a considerable distance away (for example, more than 300 ft. away).

The amount of air required to convey concrete depends upon the specific gravity of the materials, the smoothness of the pipe, the number of bends in the pipe line and their radius, the distance conveyed vertically and horizontally, and upon the pressure or velocity of the air used. For the standard size mixers the amount of air required is 2 cu. ft. of actual free air compressed to 100 lb. per sq. in. per lineal foot of pipe per batch. In other words, to convey one batch 500 ft. it will take 1000 cu. ft. of actual free air compressed to 100 lb.

Based upon this figure is drawn a curve to show the amount of air required to convey concrete at various distances. This curve is based upon practical observations on a number of jobs, and certain assumptions have also been made in order to complete the storage tank in the time required to shoot a batch. Thus, in the figures assumed in this curve certain conditions of the concrete operations are as follows: 20 seconds are allowed for opening the door and charging the mixer after each batch has been discharged and the air valves closed; 5 seconds are taken as the length of time to convey a batch each 100 ft., and as the distance becomes greater the number of batches per hour decreases until with 2500 ft. the number is 24, and the amount of air at this distance is 2000 cu. ft. per minute. It should be borne in mind that if it is desired to get the maximum output possible, the capacity of the compressor should be great enough to build up the air pressure in distance 1000 ft., it will require 2000 cu. ft. of free air compressed to 100 lb., and the time required to shoot the batch will be 50 seconds plus the time required for loading the next batch (20 seconds) or a total of 70 seconds. This requires, then, for a maximum capacity of operation a compressor which will provide 2000 ft. of air in 70 seconds, or 1700 ft. per minute. It should be borne in mind also that we are speaking of actual air and not of compressor ratings. A 600-ft. compressor will produce actually about 480 ft. of free air or 80% of its rating.

One of the first questions asked by the engineer is, "How is the concrete mixed?" This is explained by making a study of the conditions which affect the batch from the time it is placed in the mixer until it is delivered in place in the forms.

In loading the mixer the ingredients, cement and water are usually placed in a measuring hopper so that when the hopper is emptied into the mixer the first commingling of the ingredients takes place. This first commingling is not particularly important, as it is very slight. When the air is turned on that portion of the batch, which is at the bottom of the mixer, in front of the conveying air jet, it is first to move and is instantaneously followed by portions dropping from

above. As the mixer has the shape of an hour glass, the central portion of the batch in the mixer flows down first and the portion in the sides follows in the stream from the upper part, exactly as sand flows in an hour glass. During this operation the mingling of the different ingredient parts causes the smaller ingredients to flow into the voids between the larger ingredients. As the portions of the batch drop into the lower air stream, which has a velocity of about 5000 ft. per minute, these portions are carried along in suspension much as dust is carried along in a storm, except that the particles are much closer together. Although the speed of the air jet is very high, the speed of the concrete materials is much slower. The speed of the concrete varies according to the amount of voids in the materials which permit the air to pass through. The air in passing through the voids tends to carry with it the smaller ingredients—that is, the sand tends to fill the voids between the rocks and the cement tends to fill the voids remaining, and, as the voids become filled up with the smaller ingredients passing through, the speed of the mass increases, the pressure of the air behind the mass increases with the decrease of the voids in the mass, and the speed of the mass concrete increases.

Now, in this explanation of the mixing process, it is assumed that the air velocity passing through the pipe is sufficient to keep the materials in suspension, and it is important to have a sufficient air pressure to keep the materials in suspension, because when the air velocity is reduced the materials simply roll and tumble along the bottom of the pipe. The concrete will also mix in this manner, but it is not conducive to good operation and makes a dirty pipe line, which is liable to become plugged. In shooting concrete, therefore, it will be found that with an 8-in. pipe and with materials of the specific gravity of limestone, the pressure should not fall below 50 lb., as the materials will then commence to drag along the pipe. Any air expended below 25 lb. is wasted when blowing concrete through an 8-in. pipe.

A Revelation in the Production of Concrete Building Stone

"Realizing the growing demand for a practical mould for producing poured concrete stone, in lieu of the cumbersome cast iron and boiler plate moulds on the market, we have designed what we style our Flexo Moulds, made throughout of Galvanized Sheet Steel. They will not rust nor corrode, nor stick to the wet mortar, but produce a stone with faces as smooth as pressed brick," writes the Flexo-Concrete Mould Company.

"Flexo Moulds are made in two styles, a fifteen-unit wall type, as illustrated on this page, and the four-unit corner type. The fifteen-unit mould is composed of but five distinct parts, viz.: two side rails, fourteen intermediate cores, two end or half cores, fifteen pallets and six clamps. These parts being interchangeable, the entire mould can be assembled and secured with the clamps in three minutes. The entire fifteen-unit moulds weigh but a trifle over one hundred pounds, but one sack of Portland Cement, two parts sand and four parts aggregate poured in this mould produces fifteen 8x8x16 Concrete Building Stone, with a minimum of labor.

With this equipment is included a very novel yet practical process of making faced stones. By the use of a spreader riding on the top of the side rails to evenly distribute any facing desired and a large roller following the spreader troweling the facing into the wet mortar,

producing a beautiful face with all the lights and shadows and the permanency of natural stone.

Flexo Moulds are so constructed that the clamps and side rails may be removed after the stone has stood a few hours and with an extra set of cores and pallets the capacity of each unit is doubled at a very nominal additional charge.

The entire equipment is priced at a very nominal figure and it will pay interested parties to communicate with us. We will ship to responsible concerns on thirty days' trial." Write the Flexo Concrete Mould Company, care CEMENT AND ENGINEERING NEWS, 672 Transportation Building, Chicago.

Basalt and Related Rocks (Trap Rock)

The well-known group of road-building rocks which includes basalt, diabase, and some other dark igneous rocks that are very similar in mineral composition and physical properties furnished 9 per cent of the value of all the stone produced in the United States in 1917, according to statistics compiled under the direction of G. F. Loughlin, of the United States Geological Survey, Department of the Interior.

The total value of the basalt produced in 1917 was \$7,570,885, which is \$95,412 or 1.2 per cent less than that in 1916, and the value in 1916 declined 10 per cent (\$822,925) from that in 1915. The quantity of this stone produced decreased from 10,233,640 short tons in 1916 to 8,852,640 short tons in 1917, a decrease of 14 per cent. Most of the stone of this class now quarried is crushed for use as road metal and in concrete, and in small part for railroad ballast. In 1917 this crushed stone represented 91 per cent of the quantity and 87 per cent of the value of the basalt and related rocks sold in the United States, and 20 per cent of the quantity and 22 per cent of the value of the total crushed stone sold.

The sales of the 8,067,582 short tons of crushed stone valued at \$6,600,957, classified according to use, were divided as follows: Road metal, 3,751,396 short tons, valued at \$3,124,088; concrete 3,296,711 short tons, valued at \$2,654,410; railroad ballast 1,019,475 short tons, valued at \$822,459. There was a decrease of 940,792 short tons (10 per cent) in total quantity, but a small increase, \$61,949 (1 per cent), in the total value of crushed basalt and related rocks in 1917. The average price per ton in 1917 was 82 cents, 9 cents more than in 1916. Road metal showed the largest decrease in quantity, 516,604 tons (12 per cent). The quantity of concrete decreased 341,705 short tons (9 per cent). The value of road metal, however, decreased \$68,536 (2 per cent), and that of concrete increased \$69,346 (3 per cent). Railroad ballast decreased in quantity 82,483 short tons (7 per cent), and increased in value \$61,139 (8 per cent).

The principal states producing this kind of crushed stone, named in order according to rank of value of output, are New Jersey (road metal and concrete); Pennsylvania (road metal and railroad ballast); Connecticut (road metal and concrete); California (concrete). Each of these States produced over 1,000,000 short tons, valued at more than \$900,000. New Jersey, Pennsylvania and California each decreased in quantity and increased in value of output during 1917; Connecticut showed increase in both quantity and value. In 1916 New York was included in this group, ranking third, but a large decrease in both quantity and value in 1917 reduced this State to fifth in rank.



Electrically Operated Plant of Niles Sand, Gravel & Rock Company

Sand and Gravel Deposits of the Niles Sand, Gravel & Rock Company

An interesting as well as successful plant is taking large quantities of sand, gravel and rock from a gravel bed near the town of Niles, in Alameda county, California, to aid the purposes for which such material is used in various places, such as road, bridge and building construction, or wherever concrete is used for any purpose. The process is very unique and successful and represents a total investment of about three hundred thousand dollars.

The Niles Sand, Gravel & Rock Company was placed in operation in the summer of 1912.

The Alameda creek at Niles is quite wide, and the bed is filed with a deposit of sand and gravel washed down from the hills by the heavy rains of many years. There are also some very large boulders. The sand and gravel must be washed out, the sand separated from the gravel and the gravel itself separated by means of large revolving screens into the various sizes that are commercially valuable. Those that are too large are run through a 36-inch Symons disc and No. 5 Gates crushers and make a very fine grade of crushed rock.

There is a large dragline excavator operated by electric motors. This excavator runs on rollers, and by means of the long boom gathers the material and deposits it in the cars that carry it up the inclined cable railway, where it is dumped into a hopper and fed on to a belt-conveyor that takes it to the top of the plant. The motor installation on the excavator consists of a 112-horsepower Westinghouse motor to operate the dragline bucket, a 22-horsepower motor for revolving the excavator and two small motors of six horsepower each, direct connected to air compressors to furnish air to operate the brakes.

A general view of the plant shows the inclined railway hoist, the hopper and belt-conveyor to the top of the crushers. The large storage bins are in the rear and are better shown in the picture, which also shows the railway track from the main Southern Pacific line and the method of loading by gravity from the large bins. The loaded cars of material are hauled up the incline by a steel rope around a drum, the power for

which is furnished by a 75-horsepower Westinghouse motor. The belt-conveyor consists of a conveyor-belt thirty inches wide, and is also operated by a 75-horsepower Westinghouse motor.

When the material, sand, gravel and rock has reached the top of the main plant those rocks over 2½ inches are passed down to the 36-inch Symons disc and a No. 5 Gates crusher and reduced to a proper size. The balance of the material is carried across to the top of the bins, the dirt is washed out by means of two large streams of water through nozzles and the sand separated from the gravel which in turn is run through ten long revolving screens to get the exact sizes for the proper bins, and all sizes are again washed with clean, fresh water under high pressure in each of the ten screens; and the sand is washed in four additional sand-washing boxes, making a concrete or topping sand of the very best quality. After the material has been carried to the top of the plant by the belt-conveyors, the other movements, including the loading of the cars, are accomplished by means of gravity.

There are two crushers to handle the boulders and rocks that are too large for commercial purposes and reduce them to crushed rock of a proper size—a 36-inch Symons disc crusher of a capacity of seventy tons per hour that handles all that will pass through a 4-inch opening, and a No. 5 Gates gyratory crusher of a capacity of fifty tons per hour that handles those of a larger size. Each crusher is operated by a 50-horsepower Westinghouse motor. The material from the two crushers is carried back by a belt-conveyor twenty-four inches wide, which is operated by a 15-horsepower Westinghouse motor, and dumped on the main conveyor, so that the crushed rock is thoroughly mixed in with the uncrushed and the mixture makes a particularly good grade of concrete material. The water for washing the material is pumped from fresh water wells adjacent to the plant by means of a 1,000-gallons-per-minute centrifugal pump operated by a 50-horsepower Westinghouse motor, and an interesting thing in connection with this pumping plant is that the water, after having been used to wash the material before it goes to the bins, is used to irrigate many orchards on lands adjoining the plant. This forms an interesting example of conservation.

The entire plant, with the exception of the two locomotive cranes which are used for switching cars and with the 15 $\frac{3}{8}$ -yard clam-shell bucket is also useful in loading cars from storage piles, is operated by electric power, there being motors of a total capacity of over 500 horsepower installed.

The vast amount of storage, consisting of over one thousand carloads of washed, crushed and segregated materials, is principally drawn from during the winter months, this being loaded for shipment by a locomotive crane. The modern equipment of the plant, coupled with this storage system, gives to the consumer a perfect service. These storage piles are of correctly sized materials for all classes of work, including concrete aggregates for buildings, bridges, road construction, roofing and paving purposes.

White Scum on Brickwork

Question—In one of the houses which I am now building, there is a brick mantel; and the alkali comes out, leaving a white substance in the mortar joints. The bricks are hard-burned, buff or mottled color. The mortar used was made of lime and Portland cement and sand. The mortar was colored chocolate. The coloring was mineral black and mineral red mixed. Now what I should like to know is, how to clean the brickwork so that it will stay clean without any more of the white stuff coming out, and at the same time not injure the color of the brick?—T. M., Fredonia, Kan.

Answer—The trouble which you are meeting is probably due to efflorescence, which may come either from the mortar or from the bricks themselves.

Efflorescence, often termed "whitewash," is a white scum that sometimes appears on the surface of brick walls after they have been soaked with rain or in the presence of marked atmospheric humidity. This scum is due to the presence of soluble salts in the clay or mortar. In some cases, where the clay is the cause, these white patches appear on the brick when taken from the kiln. The presence of sulphuric acid salts on the brick in the drier had not been noticed; and if the brick are well burned, the scum is welded firmly to the clay, and no amount of washing with the strongest acids will remove it. The scum in this case is easily seen by the purchaser, and the brick need not be bought if discolored brick are objectionable.

The brickmaker can remove the cause of trouble by mixing with the clay carbonate of barytes, which, in changing the soluble salts in the clay, such as sulphate of lime, forms insoluble sulphate of barytes and insoluble carbonate of lime. No soluble matter is left in the material, and consequently no scum will appear at any stage of the manufacturing process or when the brick are in service.

The home builder, contractor, and architect are vitally interested in learning how to deal successfully with efflorescence which appears after the building is erected and which mars the beauty of the finished structure. If it is present in immediate and general distribution after rain or during very damp weather, the scumming is more likely to have come from the mortar than the clay. The water absorbed by the mortar, in evaporating, deposits the salts of soda, magnesia, potash, etc., which it has dissolved, and leaves an unsightly scum on the wall surface.

The evaporation of water from the brick brings to the surface the soluble salts from the interior in the same way, but the action is not so rapid as in the case of mortar. In some cases, brick themselves free from these salts may show efflorescence by absorption of water impregnated with the salts in the mortar.

Efflorescence may disappear gradually under the action of wind and rains. In the case of the Monadnock Building, Chicago, in 1902, the efflorescence was marked throughout the sill length of the 15th story. Each year the line of efflorescence dropped until at the time of writing, but few signs of "whitewash" can be noted, and these on the lowest story.

Waiting for efflorescence to disappear, however, is a lengthy operation. A quick way to remove it is by using hydrochloric acid mixed with five times its volume of water. The wall is first thoroughly dampened, then well scrubbed with the acid solution; after scrubbing, the wall should be washed perfectly clean with clear water. Dilute nitric acid is also sometimes used for this purpose.

Further efflorescence may be stopped by using a water-proofing compound on the wall. In what is known as the Sylvester process, the effect is produced by alum and soap solutions. The alum solution is made in proportion of 1 lb. of alum to 1 gallon of water. The soap solution is composed of 2.2 lbs. of good soap dissolved in each gallon of water. The wall surface, at the time of application, must be dry, and not colder than 50 degrees F. The soap solution is applied at boiling temperature. This coat is allowed to dry for 24 hours, when the alum solution, at about 60 to 70 degrees F., is applied. This method of water-proofing has been in use many years and has proved quite effective. As it prevents moisture getting to the brick, it naturally prevents efflorescence also. It is recommended that aluminum sulphate be substituted for alum in the solution noted above, as being cheaper in first cost and in quantity required.

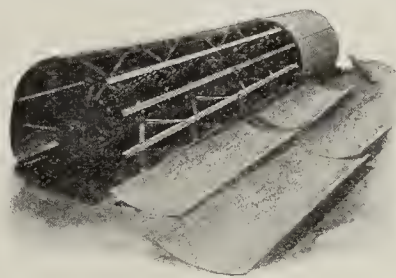
There are also effective water-proofing compounds sold on the market under various proprietary trade names. These should always be used in strict accordance with the directions prescribed by the manufacturers.

The Hipco Concrete Culvert Form Concrete Barges

Everyone interested in good roads and good culverts is probably convinced of the decided superiority of concrete over other culvert materials.

The only excuse for putting in any culverts of such costly and temporary material as clay pipe, corrugated iron and wood has been the expense and trouble of making forms for concrete culverts.

At first, wooden forms were used, but they were unsatisfactory. The time, expense, labor and material used made the cost prohibitive and the work was rough



and unattractive when completed. Then a steel form was manufactured which could be collapsed and removed after the concrete had set. This was a great improvement over wooden forms and better results were obtained. But the cost of the steel forms is considerable and they are open to this objection that a different form is needed for each size of culvert and as different sizes of culverts are necessary, a contractor, or township board or whoever was building the culverts would need so many different sizes that few could afford to buy the forms necessary to build even a dozen sizes of culverts.

The Highway Iron Products Co. of Ligonier, Ind., offers a solution of the culvert question which removes all these difficulties. They make and sell at a comparatively low cost, an adjustable culvert core. It can be expanded to a diameter of 60 inches and collapsible to a 22-inch diameter. It is instantly and automatically adjustable to any size within these limits and a culvert of any intervening size can be built over it. At any size it is braced, locked and round. The Hipco concrete culvert form is built in units 8 inches long and will build a culvert with flat bottom which is widest at its lowest point (in 39 different sizes from 22 inches wide to 60 inches, inclusive) for less than half the cost of building a concrete culvert in the old-fashioned way.

Link-Belt Electric Hoists in the Service

By James Monroe

With the energy that awakened all the war industries throughout the country, went the quick intelligence of the American brain to increase production intensively. This taxed our ingenuity to the limit, as the labor turnover has increased enormously and the scarcity of trained mechanics is a by-word.

The shop manager had to depend greatly upon me-

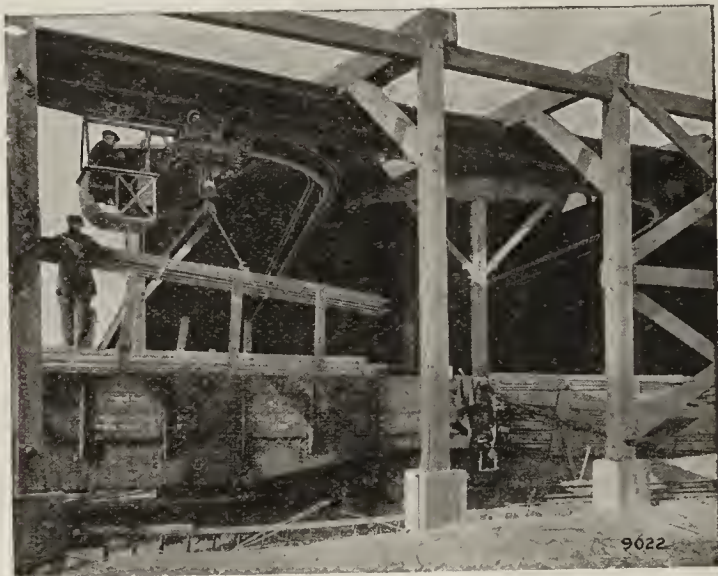


Fig. 1

chanical means for increasing his output. With long deliveries on machine tools, their purchase meant no immediate relief. He had to cut down the time spent in handling raw material and finished product through the shop. There are three distinct phases to this problem:

1. Unloading raw material from cars.
2. Carrying material and parts through the shop between operations.
3. Loading the finished product on the cars.

A very satisfactory and efficient method of shortening these operations, and also reducing their cost is the application of the Link-Belt Electric Hoist.

Fig. 1 shows one of these machines unloading pipe from a gondola car. This class of material, and plates and shapes as well, may thus be handled with the greatest ease.

Hoists simplify the handling problems throughout a plant in countless ways. Motor trucks played a big role in all departments of the army. One of the overhead-cage-hoists is handling truck bodies at an important Government plant. Hoists are also assisting in speeding up ship production, and in the work of the Navy Yards.

With the great scarcity of cars and high demurrage

rates, quick unloading has been vital. For loading gondolas, the load may be brought directly over the car and then lowered. A well-known manufacturer of Government truck bodies has seen in the Mono-Rail hoist system an ideal method. Fig. 2 shows the runway. The operator has just lifted a body from the storage pile, and is ready to carry it out over the car. This track system is in the shape of the letter U. The curved part covers the storage area, while the two



Fig. 2

straight sections run over two parallel sidings. This is an important link in the production system.

The electric hoist did not need the war to bring it into the public eye, but its scope has broadened, and it has shown some of the war industries how to operate intensively and efficiently.

What are the Opportunities in Rural Contracting?

Speaking to you as a contractor, what is your opportunity to develop in your community a good and profitable business in rural contracting? Large capital with great equipment is not demanded at the start and can be later acquired. Most large businesses have arisen from small beginnings. The qualities needed are alertness, ability and the capacity for hard work.

Before considering the ways and means of handling such work, an investigation should be made to determine whether there is a demand for permanent improvements on the farm. Today, farming is much different than yesterday. There are gasoline engines for sawing the rails, instead of the old bucksaw that ran by hand power. These same engines draw forth their water instead of the old oaken bucket. There have been many improvements in farm machinery. Great numbers of farmers and even their hired help own motor cars. The farmer lives better than he used to and he is awake to the topics of the day. Those who considered him a back number are rapidly changing their viewpoint.

The rural dweller has been quick to realize the value of permanent improvements, and you are probably aware how many farms are being modernized and rejuvenated by tearing out and replacing old decayed wooden structures with the very adaptable and time-defying building material—concrete. Go almost anywhere in the country and you will find concrete coming into its own on the farm. Cement companies are receiving scores of inquiries daily on concrete construction for the farm. If you will ask your cement dealer what proportion of his cement sales are for farm use, he will likely tell you about two-thirds, for such is con-

sidered the proportion (excepting large cities). Clearly there is a demand for farm improvements of concrete.

Most of this work is done by the farmer with his own help and during spare time. Much more is desired and would be done under more favorable conditions. First of all, the farmer is primarily a tiller of the soil, an agriculturist in the stricter sense of the word. In general he is not a blacksmith, a plumber, a manufacturer or a contractor. True, every farmer should be handy with tools and should understand concrete and its uses, but each man excels at his own trade. He understands better than you, no doubt, how to get the most out of his land and can secure more bushels of potatoes per acre, or more butter per cow. On the other hand, you understand better than he the principles of concrete construction. You could doubtless make better concrete with the same amount of cement per cubic yard, or save material by better design.

Right here is the important point. If you can save the farmer time, trouble and money, and make money yourself, you are both going to profit and be satisfied. There are in fact many savings to be made in ordinary concrete work. Proper proportioning of materials, for example, is one way. Consider two mixtures which are commonly used—a 1:2:4 and 1:4. They are re-

garded as interchangeable, depending upon the aggregate at hand. When the sand is separated from the gravel and recombined, the 1:2:4—or one part cement, two parts of sand and four parts of gravel is the common mixture, but if the material is used as it comes from the bank, or bank run material, in other words, a 1:4 mixture, or one part cement and four parts of bank run material is considered necessary to make the concrete the equal of that made of the first mentioned proportions. The percentage of sand is usually too high for that of gravel in using bank run material. It is therefore economy to screen this through a one-quarter mesh sieve, separating the sand from the gravel and then use the materials with the cement in their proper proportions. The saving in this case would be about one barrel of cement to five cubic yards of concrete. Again, by using clean aggregate, better concrete is obtained, and hence less is required for a structure equally strong. By proper reinforcing, less cement may be used and thus a saving realized. The technical departments of cement companies are ready and willing to assist users of concrete in these particulars, but such features are observed for the most part by the man who makes concrete construction his business, for it is only by following an art studiously and closely that one becomes skilled in its finer application.

Pit-Run Gravel Makes Poor Concrete

Test of Pavement Base Shows Harmful Results of Using Unscreened Material—Recommendations for Proper Construction Methods Are Made

The danger of using pit-run gravel for concrete work was made clear in the report of R. J. Marshall, B. A. Sc., instructor in the department of applied mechanics of the University of Toronto, made from examination of a roadway sub-base at London, Ont., which had been the object of considerable criticism. Samples of concrete taken from the pavement and some 6-inch cubes were tested. Gravel from two material piles, one containing pit and the other river gravel, was divided into sand and stone by sieving on a standard quarter-inch sieve. The pit gravel was found to contain 49.8 per cent sand and 50.2 per cent stone, while the river gravel showed 58.2 sand and 41.8 stone. These samples were a fair average of the quality of the material which was used in building the pavement.

This work was done under specifications which required one part cement, four parts of good gravel containing not more than 40 per cent of sand; it is also specified that all stone mixed with the concrete shall pass a 2½-inch ring. Mr. Marshall found that 90 per cent of the material he saw would not fulfill the specifications with regard to relative proportions of sand and stone; also, stones of as great as 5 inches in diameter were to be seen, mixed in the concrete.

The purpose of the specifications is that the cement added should fill the voids in the sand, and this mortar should then fill the spaces between the stone. The specification presupposes a void of 33⅓ per cent in sand. The tests showed the voids to be 33.7 per cent for the pit and 34.1 per cent for the river sand. The tests were made with the material dry and shaken in such a way as to approximate the conditions of mixing and laying of the concrete. From this it is evident that any less than one part of cement to three parts of sand will provide insufficient cement to make a good mortar. A large percentage of the river gravel would not give any better proportion than one part cement to five parts sand, to three parts stone.

Improvement Methods

One method of improving this condition is to add

enough stone to make the proportions 1:3:5, but Mr. Marshall advocated the separation of the gravel into sand and stone and remixing them in the proper proportions on the site of the work under construction, estimating the cost to be 25 to 35 cents per cubic yard of concrete. The river sand, as separated, is clean, sharp and of good quality. It lacks the finer particles which tend to make a dense mortar. Plotting comparison of the river and pit sands with an ideal sand, it would be noted that on the finer sieve the curve of both sands comes considerably below the ideal sand. If the addition of the fine sand could be accomplished without great cost, it would certainly improve the mortar.

The stone consists largely of limestone and dolomite pebbles, which are hard and clean. A small percentage (not more than 1 per cent or 2 per cent) of sandstone, granites and shales in a semi-decomposed state, are present in the gravel, but this percentage is not enough to affect seriously the strength of the concrete. The stone as used varies in size from ¼-inch to as large as five inches, and apparently the large stones are allowed to go into the concrete.

Results of the Test

All of the samples of concrete appeared to have the required proportion of cement and the concrete was fairly well mixed, although too much water was used. A photograph which the writer has seen shows mortar bed of a stone taken from one of the six-inch cubes which were tested. The notable feature of this photograph is the large percentage of void space, also the absence of any bond between the mortar and the round pebbles. Both of these conditions result from too much water.

One sample of concrete taken from the roadway showed a condition of bridging. Mortar had been raked along the sub-grade, then stones segregated on top, and then mortar placed over the top of that again. The result of this treatment was that between the two

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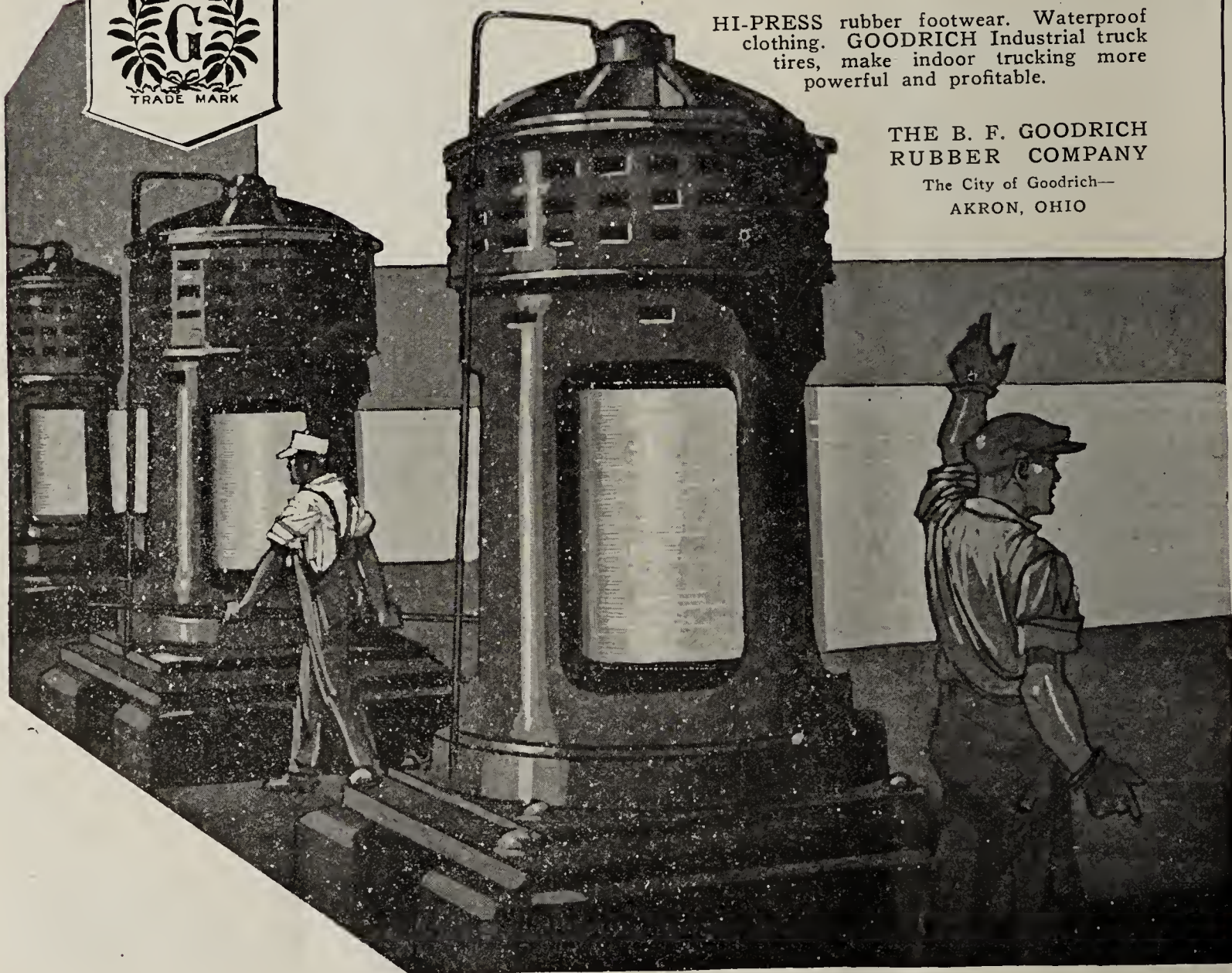
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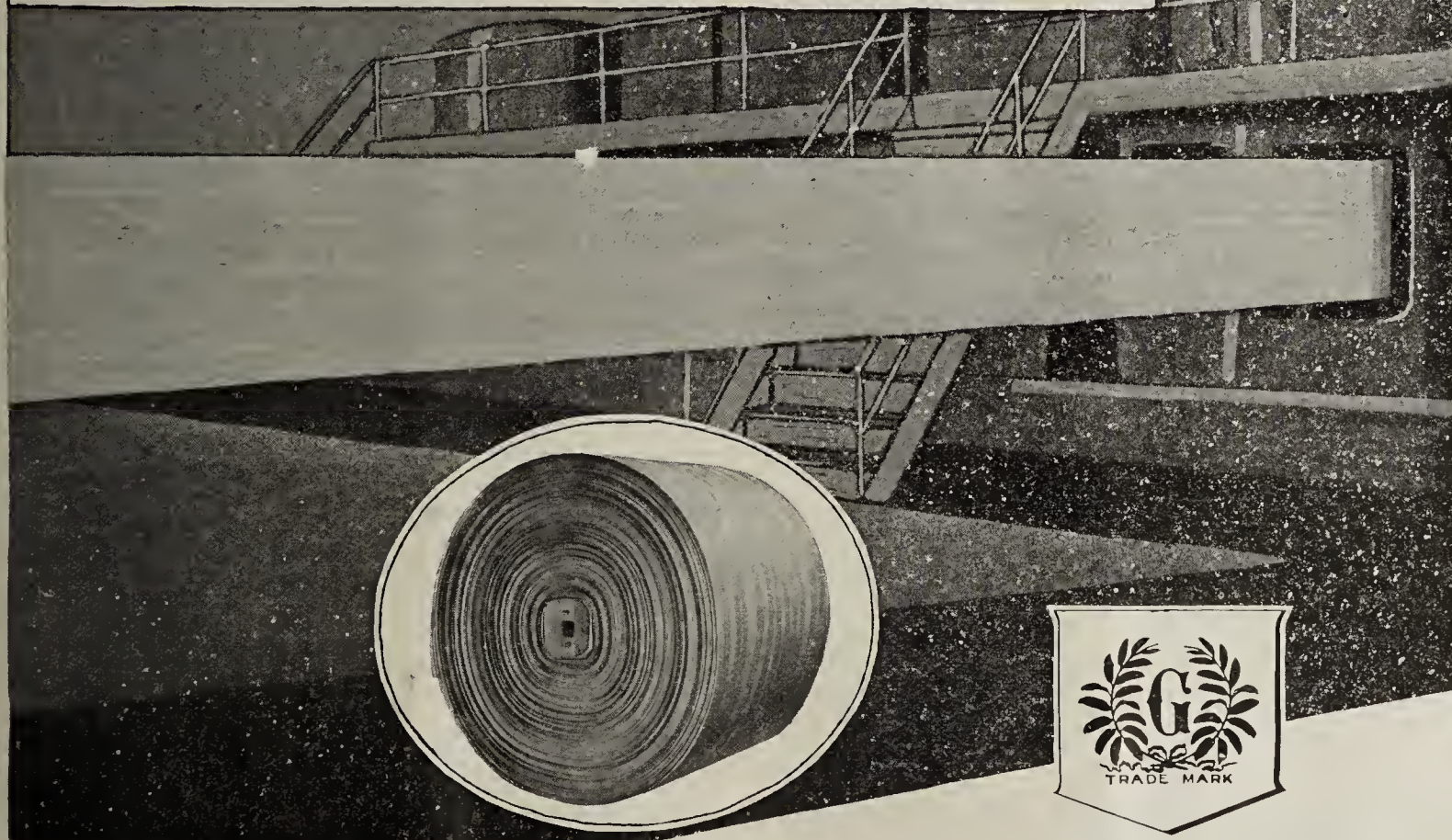
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layers of mortar, less than $1\frac{1}{3}$ inches in thickness, there was a space without any mortar between the stones. To illustrate the effect of segregating the large stones a photo was taken of the fractured surface of one of the six-inch cubes. This shows the lack of adhesion of the mortar to the stone and also why this cube withstood a lesser stress than the others tested.

Recommendations for Good Practice

The following recommendations were made:

1. On account of the uncertainty which exists between the sand and stone proportions, it becomes of prime importance that the sand and stone should be separated by screening. But before the material is screened, it should also be run through a crusher, set for 2-inch material. The crushing reduces the stone to uniform grade, and eliminates the large stones, which gives the best concrete stone. It also adds crusher dust from the broken stone and pulverizes some of the sand particles to supply the finer material necessary to the sand; and it tends to complete the breaking up of the sandstone, shale and granite pebbles which are in a semi-decomposed state. The screening should be done without water if possible, as the water would tend to take out the fine material that it is advisable to retain.

2. The concrete should be mixed for at least one minute, such time to be taken as the time that concrete is actually in the mixer.

3. Only enough water should be added to give a concrete which is clammy and on no account should concrete be used which will flow in the spout when the spout is inclined at less than 60 degrees to the horizontal.

4. It is necessary that all concrete should be thoroughly tamped, as the tamping helps to work out any excess water and improves the density and strength of the concrete. Tamping will also help to eliminate the bridging.

5. The specifications in use should be rewritten to incorporate the changes recommended, and all indefinite phrases such as "properly protected" and "proper intervals" should be given a definite meaning, explicitly stating the degree of protection required and the intervals at which the pavement should be sprinkled. Every indefinite point in a specification means that it becomes increasingly difficult for an inspector to enforce such clauses.

6. The sand also should be tested regularly, and a record kept of all such tests. Test blocks could be made up from each day's mixing and kept as a part of the progress record. These could be stored and tested and if trouble were to occur, they might prove very valuable, or if a daily check on the concrete were desired, they could be tested at the end of seven days.

7. All material should be dumped on planks and kept securely separated from the sub-grade soil.

8. The materials used should be accurately proportioned by measuring, either in a box or a wheelbarrow.

Sand and Gravel News

Members of the Iowa Sand and Gravel Producers' Association held their annual convention in Des Moines, February 27 and 28. Sessions were held at the Chamberlain Hotel. C. B. Fletcher, of the Flint Crushed Gravel Company, is president of the association and C. V. Ray, of the Des Moines Sand and Gravel Company, is secretary.

The Columbus (Ohio) Consumers' Supply Company, which operates its sand and gravel department under the name of the Island Sand and Gravel Company, has

purchased two new five-ton dump trucks in order to handle deliveries in that department. The sand and gravel plant is located at Mound street and the Scioto River.

J. H. Rodgers, general manager of the Rodgers Sand Company, Pittsburgh, Pa., reports that this company is working to the capacity of three diggers at the present time, and that operations have been maintained at a good status throughout the winter. In this connection it is set forth that the company has had more business during the past winter than ever before in its history.

The Ohio River Sand Company, the E. T. Slider Company, and the Nugent Sand Company, Louisville, Ky., have been busy for several days in getting all of their river dredging equipment into shape for work. The Ohio River Sand Company handled the first barge of sand up its incline for three months the last week in March, and from now on will be busy. The sand and gravel people are feeling a little more optimistic as a result of some good street, sewer and road contracts.

Bangor (Maine) Cast Stone Products Company, which has just resumed operations, is giving preference to returning soldiers and sailors in filling vacancies on working crews, and announces an important addition to the washing, screening and crushing plant, which is to be erected at once. The company's expanding field is evidenced by its projected construction of a foundry in the city of Bath.

The California Building Material Company, whose gravel and sand plant at Niles, Calif., has been in successful operation for the past eleven years, and whose gravel and sand products have been used exclusively on many important concrete structures, the specifications of which were rigid and exacting, have made the interesting announcement that they have acquired the famous gravel properties and plant of the Grant Gravel Company at Eliot, near Pleasanton.

With these augmented facilities, the California Building Material Company is now equipped to deliver a total of 5,000 tons of washed gravel and sand every twenty-four hours.

Service and quality have been the potent factors in the rapid growth of this company, the largest producer of gravel and sand in Central California, with main offices located in the New Call building, San Francisco.

American Concrete Pipe Association

A large majority of the nearly four hundred manufacturers of concrete drain tile and sewer pipe in the United States and Canada are directly represented in the new American Concrete Pipe Association, which is hailed as an epoch-marking advance step in that field. It is stated that the plan contemplates assimilation of the Pacific Concrete Pipe Association and the Northwestern Concrete Pipe Association. The headquarters of the new organization is at 210 S. La Salle St., Chicago, Ill. The officers are: President, W. E. Goodman, Saginaw, Mich.; vice-president, A. N. Shearman, Knoxville, Tenn.; secretary-treasurer, G. E. Warren, Chicago.

The Louisville Cement Company, at Speeds, Ind., has eight women employed at their plant, whose work is just as satisfactory as the men, the company officials declare.

Promoting, Arranging and Equipping A Large Concrete Products Plant

In the establishment of a concrete products company, its organization and equipment are questions of such great importance that they should be approached with a firm determination of making a comprehensive study and a searching investigation of their various vital points.

The first question confronting an individual or group of individuals contemplating such an organization is one of financial aspect relating to the amount of capital required and the most logical means of securing it. A concrete products plant, and I speak in a broader sense, of meaning a large modern, well-equipped plant, capable of manufacturing a great variety of products and operating thruout the entire year, cannot be successfully inaugurated and handled by a limited capital. It becomes necessary to provide sufficient financial strength to permit of the acquiring of a suitable site and location of buildings, procuring modern equipment and still retain sufficient funds to provide for the purchase of various manufacturing supplies as well as to support the sales expense. On a small and limited capitalization some of these features are bound to be slighted if not entirely eliminated.

The result of study and investigation leads one to presume that a capitalization of from \$35,000 to \$50,000 seems to be the minimum amount of money necessary for such an undertaking. These funds can be raised by the organization of a stock company or as is sometimes the case one or two individuals provide for the greater part of this amount and merely issue a limited number of stock certificates to provide for a sufficient capital and the required number of authorized stockholders.

There are certain advantages to be gained by the flotation of a stock company proposition for it is by such means that a wider distribution of the interests of the company may be obtained with the resulting benefit effecting indirect advertising for the product of the company. On the other hand this form of incorporation, especially if the stock is sold to a great number of people and in small lots, often causes a great deal of friction among the smaller stockholders who are bound to interfere as is often the case to dictate certain policies which would be far from beneficial to the company. It seems advisable, therefore that the organization of a company of this kind should be comparatively limited in so far as the distribution is concerned endeavoring to procure the affiliation of strong, financial, broad minded business men.

In the selection of the officers, the board of directors, and the manager of such an undertaking, equal consideration should be given relative to their business qualifications and fitness as one would employ in selecting the executive heads of any other large manufacturing corporation. The success or failure of an enterprise of this kind rests in a large measure upon the individual chosen to take charge of the direction of its affairs. The manager should be primarily a man of broad, sound business judgment and training, and thoroly experienced in the ways of handling cement and concrete, capable of organizing his factory and sales forces.

Of next importance no doubt is the proper selection of the piece of property upon which the plant is to be erected. It is extremely advisable that the plant be adjacent to a railroad siding having a capacity for handling the cars of material if they must be shipped from adjacent points, as well as holding the empty

cars for loading of the finished product. It is not often a serious problem to procure the necessary piece of land, care being taken that it is of sufficient area to permit of a well arranged plant and at the same time afford ample facilities for storage purposes; and where the manufacturing involves large and heavy units it should be provided with means for handling them to advantage.

It is my estimation that the most serious and vital consideration in the manufacture of concrete products is the question of suitable and proper materials. First and foremost one would be surprised to learn of the large volume of water which is required daily in a well organized and equipped plant. It is obligatory, therefore, that a reliable supply of clean water in large quantities be available to be used in the making of the concrete and at the same time to properly provide means for the hardening process which is necessary. Whether this supply comes from the city water system or from a well on the property it should be clean. There should be no loam, clay or other foreign materials in it nor should there be oil or excessive alkali. Water suitable for drinking purposes is best fitted for concrete. Alkali in the water may not only be the cause of a whitish deposit on the finished concrete called efflorescence, but if in excess may effect the strength.

The other materials necessary are Portland cement, sand and pebbles or broken stone. The availability of the source and supply of these several materials should be seriously taken into account and extensive studies and surveys made to determine where the best quality of the several materials may be obtained. Of these many materials Portland cement as it is manufactured today meeting standard requirements and specifications can be obtained without difficulty in practically every state and at every railroad station for shipping to the consumer in either cloth or paper sacks and if so desired in bulk. The question of Portland cement supply therefore can be readily eliminated.

One point, however, is worthy of considerable attention in connection with the cement and that is to provide proper storage facilities. The cement should never be stored nor piled directly on the ground nor in any place where it will be subject to the effects of moisture. A dry, tight room having a floor raised from the ground so that dampness will be avoided and a good circulation of air secured beneath the floor are the prime requisites of storage accommodations. It is also well to avoid piling the sacked cement directly against the sides of a shed or room as dampness may pass through these side walls. A properly constructed cement storage shed or room will be air and moisture proof and is best constructed of concrete.

The utter disregard of the importance of carefully selecting the sand, pebbles and broken stone has been the cause of several unsatisfactory adventures of this kind, and while it may mean a little saving in cash outlay, the results are far from pleasant and result often in severe financial loss.

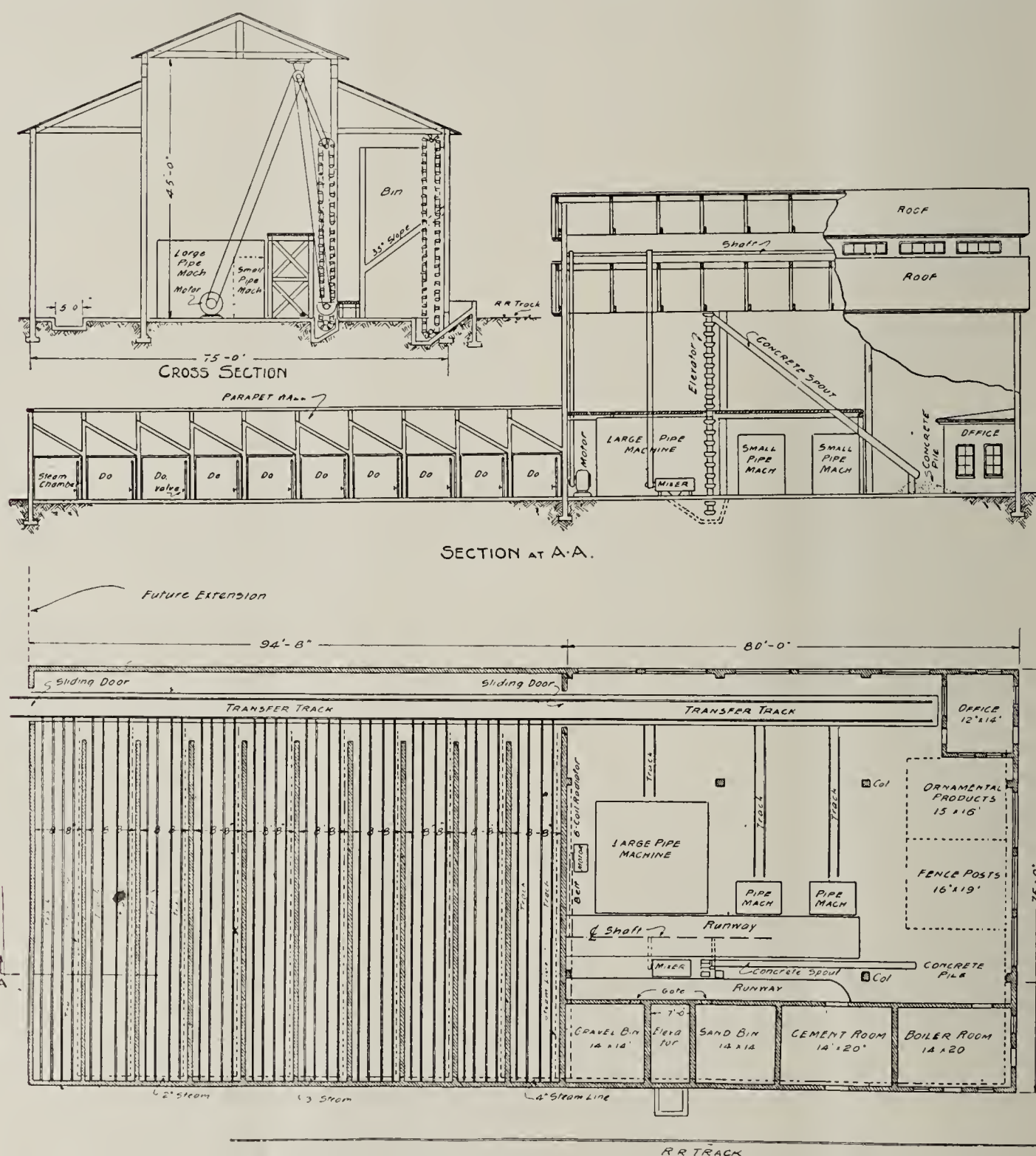
Sand and pebbles or broken stone when used in concrete are termed "aggregates." Sand is known as "fine aggregate" while pebbles and broken stone are called "coarse aggregates." In concrete sand is the material that ranges in size downward from $\frac{1}{4}$ inch in its greatest dimension, while pebbles or broken stone or the coarse aggregate range in size from $\frac{1}{4}$ inch upward. Both the sand, pebbles or broken stone must be clean

and well graded from fine to coarse with the coarse particles predominating. The particles must also be hard and tough. It sometimes occurs that the plant is erected at or near the site of large deposits of sand and pebbles, but the natural mixture of the two (usually containing more or less foreign materials), as it comes from the ordinary gravel bank is not suitable for concrete mixtures. It should be first screened and separated into two volumes, one termed "fine aggregate" and the other "coarse aggregate." Upon the care used in the proper selection of these comparatively plentiful materials depends in a large measure the ultimate success of an undertaking for the manufacture of concrete products of all kinds.

Of secondary importance are questions of economical plant layout, necessary equipment, proper hardening and loading facilities. There are so many conditions affecting the layout of a plant based upon the considerations of money available, extent and diversity of the products to be manufactured that it is an

impossibility to attempt such a layout which would be suitable for all cases. Primarily the building should be of ample size to permit of all operations upon one floor. The arrangement should be such that the raw materials of all kinds are received direct from the cars to a point in the building which will require the least handling. Adjacent to the source of the materials in the building the concrete mixer or mixers should be erected at a sufficient height that they may deposit the mixed concrete into either the machines or molds without wheeling. The finished product from the machines are then carried by wheel trucks or overhead tramways to the several hardening chambers, or in the case of small units such as brick, small diameter pipe and tile they are loaded on cars containing racks, which cars are run into the various chambers where the hardening process is to be developed.

Suitable arrangements should be made thruout the building to provide for a sufficiency of light at all times, and in winter time provision should be made



Plan for Model Concrete Products Plant. Provides Minimum Handling of Materials. Concrete is Spouted to Machines and Molds.

for keeping the temperature within the building above 55 degrees Fahrenheit. It will be found of very great value to have numerous water openings eliminating the use of long stretches of rubber hose, as generous use of water is one of the best features to be considered.

Where the plant undertakes to manufacture ornamental work, suitable space should be provided with good, sound, level floors whereon the molds and forms may be placed without danger of vibration. Units similar to fence posts and lighting standards can be very well handled by the use of overhead travelers and need occupy but comparatively small space in the hardening chamber when once placed therein. Facilities should be provided for the admission of steam to these hardening chambers, preferably thru channels in the floor in which a continual supply of water is maintained. This gives the effect of a warm, highly saturated atmosphere which is the most conducive for the proper hardening of concrete.

The details of the various kinds, types and sizes of equipment which are available would prove too lengthy and uninteresting in this article but information on these subjects may be obtained by addressing the editor of this magazine or W. E. Dunn Mfg. Co., 414 24th street, Holland, Mich., or Northwestern Steel & Iron Works, Eau Claire, Wis., who manufacture every kind of concrete products machinery. It might be said at this point that representative manufacturers of concrete equipment have been quick to grasp suggestions for improvement in their various machines which have come to them as a result of actual manufacturing experience. The equipment of today is far more efficient and serviceable than that which was available a few years ago.

After the various products have been retained in the hardening chambers for a predetermined length of time, means should be provided for their removal to the storage yard. With the exception possibly of highly ornamental and decorative units all concrete products can be stored by piling one upon the other to the extent of the facilities at the command of the manufacturer. In the layout of the storage yard, however, one of the best and most useful installations will be the placing of numerous water hydrants in the various runways whereby the products may be kept moist for as long as may be necessary, depending upon the season of the year. This has been worked out very successfully by the representative concrete products manufacturers of today, and while the expense of installation is an item to be considered, at the same time the results obtained more than warrant such initial expenditures.

The relative location of the building, storage yard and railroad facilities should be such that the materials may be handled with as little expense and labor as possible. Means should be provided for the loading of cars at a minimum outlay and this can usually be accomplished by suitable runways and overhead travelers. There is no one question affecting the concrete products industry today as great as that concerning the economical and effective layout of their plant. However, this is being solved most satisfactorily by the larger companies, and upon studying and investigating several representative plants the general scheme of layout is very similar. One of the best recommendations to make to an individual or corporation contemplating the manufacture of concrete products is to visit successful plants already in operation, learn of their experiences, their failures and successes and their final solving of the many problems with which they were obliged to contend.

Proper Radius for Turns at Intersection of Highways

Permissible Banking Has Small Effect on Allowable Speed—Number of Automobiles Necessary To Warrant Use of Extra Area

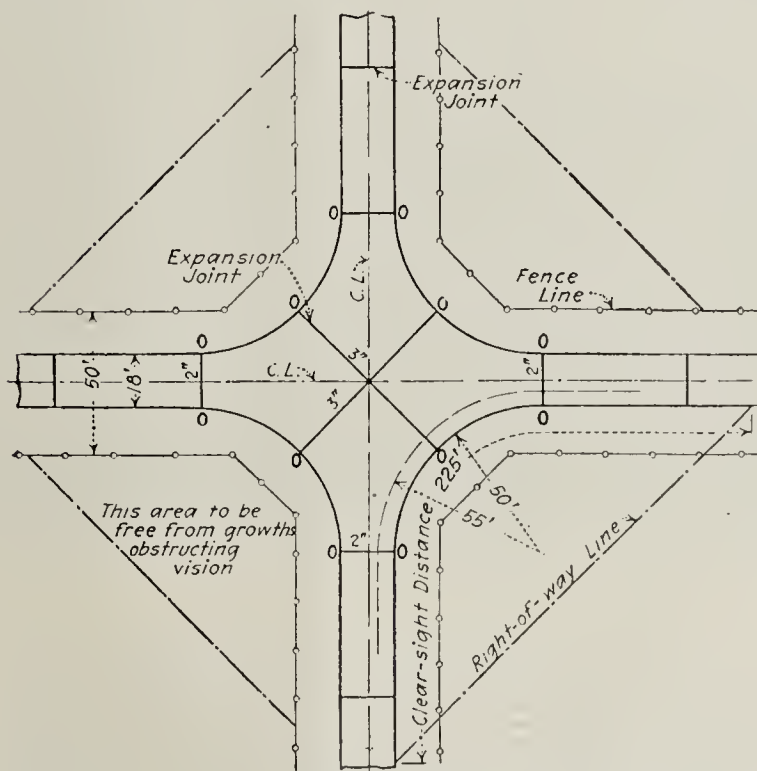
BY G. S. EATON

Assistant Division Engineer, Universal Portland Cement Company

Proper radius for turns at highway intersections should receive careful consideration. The chief relief from hard turns must come from increased radius, as the allowable amount of banking has small effect upon ease of turning. However, excessive cost for extra paving and right-of-way at long turns should be considered with reference to the extra convenience of the traffic. In this, the number of vehicles passing the point is a factor, and it can be shown that the actual saving in gasoline will warrant a change from 20- to 50-ft. radius where 112 automobiles pass, while 171 are required to warrant a 90-ft. radius. Clear-sight distance is also desirable, and an intersection combining ease of turning, clear sight and economy is shown in the illustration above.

The design just mentioned, with the analysis on which it is based, is not given because of its unusualness nor as necessarily the best practice, but rather to serve as an example of the general method of attacking the problem. Credit for the scheme used in obtaining a satisfactory clear-sight distance should be given to H. E. Bilger, road engineer, Illinois Division of Highways, whose article entitled, "A Modern Intersection Designed for Paved Highways," appeared in *Engineering News-Record* of July 19, 1917, p. 134. It should be noted, however, that the important distance is the one measured around the curve, which separates two automobiles when they become visible to each other, and is not the length of a straight line connecting the two.

In the article referred to, the design advocated calls for a 125-ft. inside radius, with small unpaved areas near the center. While having many advantages, such a layout would be expensive, and the unpaved areas, if



INTERSECTION PROVIDES ADEQUATE TURNING RADIUS AND CLEAR-SIGHT DISTANCE

not fully drained, would be dangerous to motorists. If paved with concrete, \$1400 would be a low estimate for the cost of such an intersection (exclusive of the area in the straight 18-ft. pavements), while at the same unit prices one built according to the design now suggested should not cost more than \$500, allowing \$100 for the cost of extra land required, which in each case is less than half an acre. Of course, the turning radius in the latter case is not nearly so great as with the former design.

In order that an automobile may turn without slowing down too much, a turning radius is needed that is more than the few feet which served for horse-drawn vehicles. At any particular speed doubling the radius will have the centrifugal force, which tends to cause skidding and overturning. Ease in following a curve at a fair speed demands that it be unnecessary to turn the steering wheel too suddenly. Yet economy forbids the use of too great a radius. The rapid increase in paved area, as the inside radius becomes greater, is shown by the curve plotted for various radii.

In the following analysis, an inside radius of 50 ft. was chosen because that will allow a turning radius of at least 55 ft., or even 60 ft., without the automobile getting out of its own track. Reference to the tabulations will show that no trouble should be experienced in rounding such a curve at 15 miles an hour. The centrifugal force developed is about equivalent to that present when making a turn on a 25-ft. radius at 10 miles an hour. With a 90-ft. inside radius, 20 miles an hour should be a safe speed. The plan of flattening the curve near its center was investigated, but with a radius as large as 50 ft. no considerable saving would result from following this scheme, instead of increasing the inside radius.

Superelevating of intersections was another matter carefully considered and then discarded as unwise. On double-track roads, if superelevation is used to help vehicles turning to the right along the edge of the pavement, it will make it harder for the vehicles traveling in the opposite direction, of which an equal number may be assumed. If the turns are banked the dangerous tendency to use the wrong side of the road will be encouraged. When turning on a 55-ft. radius increase in speed made possible by using the allowable limit of $\frac{3}{4}$ -in. superelevation per foot of width would be small at best. That only 16.6 miles an hour on the banked turn would be permissible, if 15 miles an hour were the safe speed on the flat pavement, is shown by the following example, where the average weight of automobile was considered 2600 pounds. Since centrifugal force varies as the square of the speed it increases very rapidly with the higher velocities.

Centrifugal force = $\frac{WV^2}{gr}$ where W = weight in lbs.,
 V = velocity in feet per second, g = force of gravity
 and r = radius.

$$\frac{2600 \times 22^2}{32.2 \times 55} = 710 \text{ lb.}$$

Centrifugal force compensated for by $\frac{3}{4}$ -in. superelevation per foot of width = 160 pounds. Total centrifugal force allowable = 870 pounds.

$$870 = \frac{2600 \times V^2}{32.2 \times 55} \text{ or}$$

$$V = 24.4 \text{ ft. a second} = 16.6 \text{ miles an hour.}$$

On curves where all traffic is benefited by superelevation and where the radius should be much greater, the advantage to be obtained is worth while; this is not the case on double-track pavements where intersections are entire-

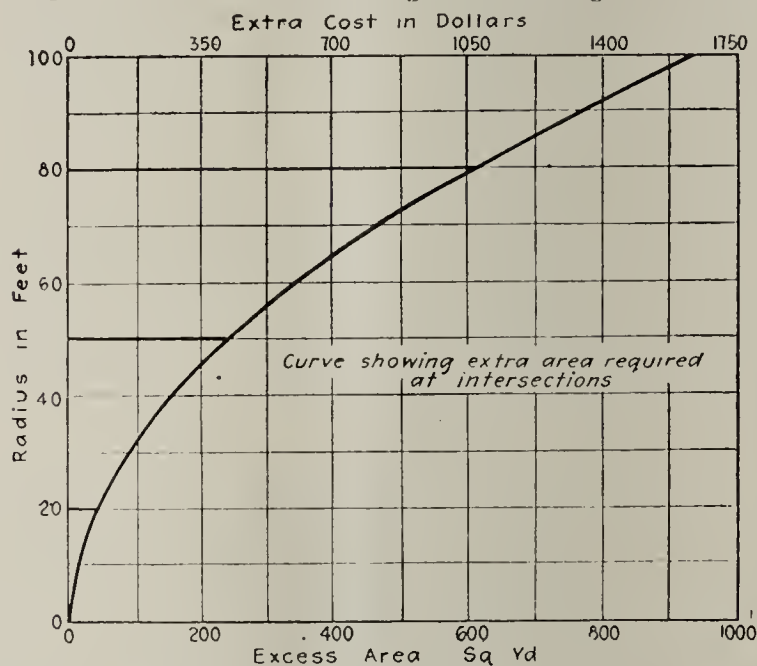
ly paved. How radius, speed and centrifugal force are related is shown in the tabulations as follows:

THE RELATION BETWEEN RADIUS, SPEED AND CENTRIFUGAL FORCE COMPUTED

Turning Radius (Ft.)	Speed (Mi. per Hr.)	Centrifugal Force (Lb.)*	Speed Compensated for by Allowable Superelevation (Mi. per Hr.)
25	8	442	4.8
	10	698	
	15	1,564	
55	10	317	7.2
	15	710	
	20	1,260	
95	15	412	9.4
	20	730	
	25	1,033	
130	20	533	11.0
	25	836	

*For automobile weighing 2600 lb.

In determining whether an inside radius of 50 ft. or more at intersections would be justified by the resulting saving in operating cost of automobiles, the following assumptions were made: Weight of average automobile



EXTRA AREA AND EXPENDITURE REQUIRED BY INCREASED RADIUS SHOWN BY CURVE

with passengers (trucks excluded), 2600 lb.; average car when traveling on level pavement at constant speed can make 17 miles on one gallon of gasoline; cost of gasoline, 23c. per gallon; tractive resistance on level, 30 lb.

AMOUNT OF MONEY SAVED BY INCREASING RADIUS

Change in Inside Radius	Change in Speed Made Unnecessary (Mi. per Hr.)	*Work Saved (Ft. Lb.)	Saving per Automobile
20-50	10-15	11,387	\$0.00075
20-90	10-20	27,330	0.00180

*Allowance made for shortened distances around flatter curves.

per ton. Only important loss in power is that needed to regain speed after slowing down at intersection.

Work done equals change in kinetic energy; $KE = \frac{1}{2} W (V_1^2 - V_0^2)$.

With 20 miles as the maximum allowable speed at intersections, the above figures give the amount saved, if it is not necessary to slow down to 10 miles per hour at the intersection. While gasoline is only one factor entering into the cost of operating an automobile, it is by far the most important one in this case.

The daily number of automobiles which will be required to justify a change from 20 to 50 ft., or from 20 to 90 ft., for the radius of the intersection is given below; these values were obtained by dividing the daily cost by the corresponding saving per automobile.

tion, traffic on many routes would warrant inter-sections with 90-ft. radii. But inasmuch as funds are usually limited a 50-ft. radius should give a satisfactory intersection at low cost, unless travel is unusually heavy.

NUMBER OF AUTOMOBILES WHICH MUST MAKE THE TURN TO JUSTIFY CHANGE IN RADIUS

Inside Radius.....	Permissible Speed (Mi. per Hr.).....	Sq. Yd. Excess Area.....	Difference in Yardage.....	Total Cost, (\$).	Annual Cost, (\$).	Daily Cost, (\$).	No. Autos Turning to Justify Improvement.
20	10	38	..	..	..	..	..
50	15	238	200	350	30.52	0.0836	112
90	20	773	735	1285	112.10	0.3070	171

*To discharge debt of one dollar at 6 per cent interest in 20 years requires an annuity of 0.0872; this was used in figuring annual cost.

Quaker Oats Company Build Mammoth Concrete Structures

The new plant of the Quaker Oats Company at Peterboro, Ont., replacing the one which burned December 11, 1916, may be compared with a double-barrel shot gun. The stock of the gun is the battery of concrete storage tanks which have a capacity of 1,300,000 bushels. One barrel of the gun is made up of the workhouse of the elevator, the flour mill, feed mill, puffed goods plant and warehouse No. 2. The other barrel is comprised of the boiler house, drying and cleaning building, oatmeal mill, package building and warehouse No. 1. The analogy might be carried farther in the puffed goods plant, but this description gives a rough idea of the layout of the plant. From the end of the tanks to the front of the warehouses the plant is 731 feet long. On the flour mill side it is divided as follows: Storage tanks, 251 feet; workhouse 60 feet; flour mill 120 feet; feed mill and puffed goods house 100 feet; warehouse 200 feet. The two buildings are separated by a double track; a double track serves the tanks and flour mill on the west side and a



Concrete Flour Mills and Storage House of the Quaker Oats Plant



Battery of Concrete Storage Tanks, Having a Capacity of 1,300 000 Bushels, Recently Built by Quaker Oats Co. in Canada

single track extends the length of the east front, while a separate track carries coal to and ashes away from the boiler house. At various levels between the two buildings above the tracks are covered bridges connecting the wings, and a tunnel under the tracks connects the basements. While the two buildings are entirely independent of each other in output and work-

ing force, some intercommunication is necessary and these passageways afford ready means.

The difficulties that the builders had to contend with under war conditions may be gathered from the fact that cars for timber were not available so they bought up a lot of used cars and made up their own trains. Materials for concrete work were hard to ob-

tain so the contractors rented two gravel pits and hauled the material in trucks and wagons to a crusher at the plant where it was put into condition to work. These difficulties in getting material finally determined the style of buildings; the west structure being of reinforced concrete throughout and the one on the east of mill construction. The engineers in charge of the work tell many stories of difficulties overcome and problems solved, that show a wonderful ingenuity and resourcefulness which can only be appreciated by those who, in war time, have attempted to assemble material which the whole world was clamoring for.

Warehouse No. 2, the puffed goods plant and the feed mill are made with the flat-slab system of construction.

The various story heights are: Basement, 11 feet; first to fourth, 12 feet; fifth to seventh, 14 feet and eighth or top story, 12 feet. The floors carry a live load of 250 pounds per square foot.

The flour mill is nine stories and basement. The first, second and third floors are flat slab type and the other floors are the beam and girder type. The height of the stories in this building are: Basement, 11 feet; first to third, 12 feet; fourth to seventh, 14 feet; eighth, 16 feet; and ninth, 13 feet 4 inches.

The entire structure was built by the Leonard Construction Company of Chicago and they have the distinction of having to their credit perhaps the largest cereal plant in the world.

Field For Cement Products

It has been put a question of a short time that the extensive development of making various products, both useful and ornamental, of concrete has received the attention it is now obtaining. It is true, we can look back numberless years and find articles of various kinds, manufactured by crude methods, of concrete for use as ornamentation as well as in building construction.

Probably no development has received the attention in the concrete field during the past five years as has been accorded the manufacture of concrete sewer pipe and drain tile. Sewers of concrete have been in use since 1861 in Brooklyn, N. Y., and today Brooklyn has over three hundred miles of concrete

Architectural Trim for Buildings

From an architectural standpoint, pre-cast decorative units of concrete have been the source of much study and investigation. Where such ornamentation has heretofore been hand-carved from solid stone, it is now possible by preparing suitable molds to make any number of pieces of exactly the same design and dimension, this naturally resulting in an extreme degree

of uniformity hitherto unavailable. It is oftentimes very noticeable that where a large amount of ornamentation is required on a building, it has been impossible to secure a natural stone or other material which would show a uniformity of texture so highly desirable from an architectural standpoint. The



The modern concrete block, tile and sewer pipe plant is equipped with steam curing rooms, so that their manufacturing process may be continued through the extreme cold weather in winter, permitting a large stock of this product to be on hand with the coming of spring and the opening of the constructing season. In this way, by operating throughout the year, manufacturing costs are correspondingly reduced.

sewers in actual service and proving eminently satisfactory. It is needless to say that the first sewers constructed were far from the quality now produced. Methods at that time were incomplete, careful study had not been given to the proper proportioning of the mixtures and the treatment of the product. Notwithstanding these severe handicaps, some of the sewer pipe made in 1861 is still fulfilling its original function.

leading architects thruout the world are realizing more fully the manifold advantages of specifying their ornamentation to be made of pre-cast concrete. It is possible today to give the surface of decorative concrete any predetermined finish in order to harmonize with the design intended by the architect.

Heavy Pre-Cast Units

From an engineering standpoint, mill and factory construction, as well as heavy railroad structures, are

today made possible thru a system of pre-cast concrete units. By this means one is enabled to watch carefully the construction of each individual member of a building having them all manufactured at one central point and in such quantities and kinds as are essential.

The present demand for concrete products of all kinds is the direct result of intensive educational campaigns fathered by the cement industry, as well as by the natural desire of engineers and architects to improve construction, and at the same time provide structures capable of resisting the ravages of fire.

It is possible to use concrete products in practically every field of constructional activity. While there are many undeveloped fields as yet, at the same time the knowledge of concrete is being more broadly distributed, and the leading colleges and schools in this country, as well as abroad, are devoting considerable time and large sums of money to investigational purposes.

The modern plant making sewer pipe and tile is equipped with steam curing rooms, so that their manufacturing process may be continued thru the extreme cold weather in winter, permitting a large stock of this product to be on hand with the coming of spring and the opening of the construction season. In this way, by operating thruout the year, manufacturing costs are correspondingly reduced.

Concrete Building Blocks

It is possible to manufacture concrete products on practically any conceivable scale of magnitude. Perhaps the most simple and least expensive concrete product installation is that for the manufacture of concrete building blocks. However, simple as this operation may be, at the same time it is not devoid of responsibilities. Care and judgment must be exercised in the manufacture of blocks, irrespective of the size of equipment, in order to produce a product worthy of favorable consideration and at the same time prove satisfactory. The model concrete products plant, with sufficient working capital in order to operate efficiently and economically, can so enlarge upon its activities by the manufacture of various products to reduce its overhead charges to a very small minimum. Concrete products plants thruout the country are diversifying their operations to a greater extent every day, and, provided a plant has sufficient ground space and equipment together with available working capital, the financial results obtained are bound to prove satisfactory.

Fence Posts Offer Big Field

Probably one of the greatest fields for concrete products lies in the manufacture of fence posts. It is practically impossible to obtain wooden fence posts today that will compare in either quality, size or price with those obtainable ten years ago. When you consider that the average life of a wooden fence post is limited to not exceeding twenty years, and very often considerably less, it means that the farmers thruout this country are renewing tens of thousands of fence posts every year. The labor cost of setting those posts is from 50 to 80 per cent. greater than it was ten years ago. By the utilization of fence posts of concrete, when once set, no further maintenance or replacement is necessary.

Telephone, Telegraph and Transmission Line Poles

In a great many portions of the west and east railroads, as well as municipalities, have been investigating the advisability, as well as the economy, of using concrete poles for telephone and electric service, trolley lines and boulevard lights. This particular develop-

ment is receiving considerable attention, and the number of cities, as well as power companies now using concrete are extremely numerable. It is a noticeable fact in the west and northwest, where electric power transmission lines traverse the wild, unsettled portions of the country, and where forest fires are a constant source of menace, concrete poles are carrying successfully the electric current generated in the large water-power developments without interruption.

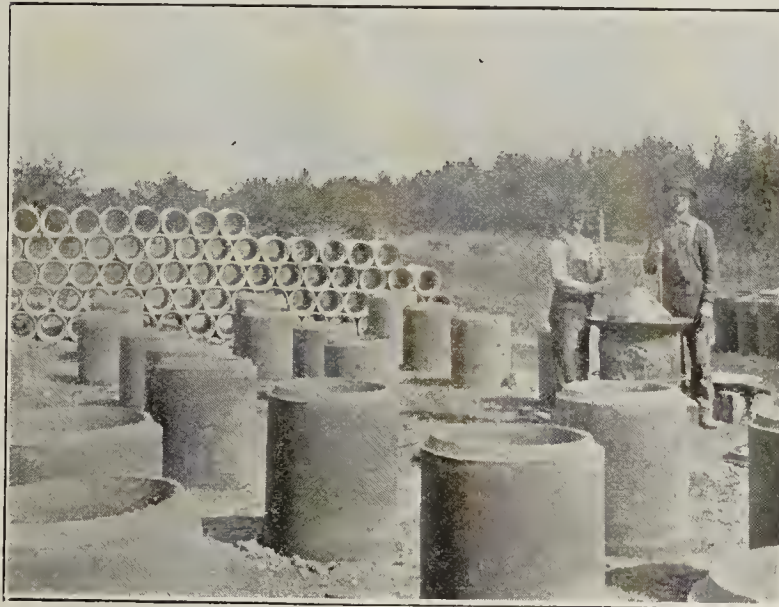
Probably no one fact within the last few years indicates the importance of the concrete products development as much as the fact that the Association of Portland Cement Manufacturers, a purely educational body whose activities are to promote the proper and additional use of concrete, have seen fit to incorporate in their organization a department devoted strictly to the promotion and handling of the concrete products field. The services of this Association are available to anyone interested in concrete products, either as a manufacturer or user, and inquiries addressed to them at 111 West Washington Street, Chicago, will receive the most careful and prompt attention.

It may be permitted at this time to state that this journal has long realized the wonderful possibilities for cement products and in order to be of assistance to its readers is devoting space in every issue to the manufacture of cement products. Inquiries addressed to this magazine concerning the manufacture and use of concrete and cement in connection with concrete products of any nature whatsoever, will be very carefully handled.

The Concrete Pipe Business and Its Possibilities

There are rare instances on record in which a man has gone into a business that he knows nothing about and made a go of it, but these examples are extremely rare and are more than offset by the great number who have lost all the capital they invested when trying to play another man's game.

There are great possibilities in the concrete pipe and drain tile business, but, like any other real business, it



Manufacturing Concrete Sewer Pipes

is a wild gamble to go in blindly. If a man came directly from the farm and suddenly started a general store or a bank, the chances are about a hundred to one that he would fail, and everyone would say, "It served him right." Yet men are inclined to start in the concrete specialties business, and if they fail because of

lack of experience, they blame concrete and cement and say there is no market for their product.

There are miles and miles of concrete sewers, pipe and drain tile being laid every year—which seems to disprove this “no good” theory. The difference lies in the fact that the man who is selling this pipe knows something about the market. He knows where the farms are that need drain tile—those located on low-lying ground. He knows where sewers and pipe lines are being placed and where culverts are wanted, and why concrete pipe will be most suitable for this work. He also knows how to make good concrete that will give perfect service under all conditions—the kind of concrete that is a credit to him and to the industry. He understands that clay makes fine bricks but poor concrete.

For the man who is willing to start out on a small scale and build himself up gradually and steadily there is a fine opportunity for business and profit in the manufacture of concrete pipe and tile. However, the man who goes into this business must make up his mind that he isn't going to make a fortune in a minute, but instead he is going into a business that will yield fine profits if handled in the right way, just like any

of some low-lying ground by putting down drain tile. If the farmer buys concrete drain tile after such an experience it is the clay tile man's fault and is not due to the fact that there is a nice pile of concrete tile in the back yard of the concrete pipe maker.

There are many types of machines available for the man who goes into this business. The catalogs of the makers of this type of equipment show all varieties and sizes. The prospective pipe man can pick out a style that will be in keeping with the amount of capital he has to invest and he can add to this as his business increases. Many of the manufacturers are in a position to give information concerning the best methods of making tile and pipe, of laying out a plant efficiently, and they will also be glad to suggest the best way of obtaining publicity for the product.

Loosening Hard Soil Without Picking

By Chas. F. Higgs, Virginia

We were digging a ditch four miles long in which to lay a water supply pipe line from the source of supply to a town which was to have water service.



This Picture Shows Ideal Arrangement of Plant and Storage Facilities in Concrete Tile Plant in Iowa

other business. The concrete pipe business is not a get-rich-quick scheme, but rather a good, substantial business where the man who makes a careful study of his product and its market can be much more sure of success than in the majority of other fields. He must not try to do more business than his capital will allow and above all things he must make a study earnestly and steadily of his aggregate, his equipment, and his field; and govern the manufacture of his product accordingly.

After learning how to make the best kind of pipe and tile and studying the field to see where pipe can be used and what sizes will be most in demand, the next step is getting the product before the eyes of the people to be sold. This most important phase of the business is often the very one neglected. Many men have made the best kind of products but have lacked the ability to sell them after they are made. It isn't sufficient to have a nice pile of fine concrete pipe out in the yard, if the clay tile man is out talking to some farmer about the opportunity for increasing the value

We encountered rock and many types of soil along the right of way and were using dynamite to dispose of the rock. The soil in many places was so hard that much laborious picking was necessary to loosen it and the time consumed in doing this was greatly delaying the completion of the work.

It was suggested that dynamite could be used also to loosen this hard soil, thus reducing and, in some cases, altogether obviating the picking. The foreman of the job, however, had never heard of using dynamite for hard soil and expressed the opinion that the blasting would throw the dirt so far away from the ditch that it would not be available for filling in over the pipe.

I expressed the opinion that this could be avoided by using charges only large enough to loosen the soil but not large enough to throw it out, as would be done if a ditch were being blasted. It was decided to try this experiment.

The tools required were two 10-pound sledge hammers and a steel drive point 1½ inches in diameter.

The sledges were used to drive the steel bar into the ground, making the holes two feet deep in which the charges of dynamite were loaded.

The holes were spaced four feet apart, each hole being loaded with $\frac{1}{4}$ pound of 40 per cent dynamite well tamped in. As we had no blasting machine, a blasting cap and length of fuse was inserted in each charge. The charge being small, a man could go along the line of charges lighting the fuses without risking any danger from the blasts going off 40 or 50 feet behind him.

The experiment was an entire success and the method was adopted for digging the three miles of ditch uncompleted at the time the experiment was made.

These small blasts loosened the hard ground very nicely. It was possible to shovel out most of the dirt without any picking whatever.

Because of the time of labor saved by the blasting, the cost of the work was greatly reduced and the time of completion of the job decidedly shortened.

Cost of Applying Stucco with the Centrifugal Stucco Gun

A somewhat difficult stuccoing job was carried out recently at Cincinnati, O., with the Hodges centrifugal stucco gun. The building was constructed with studding put up on the same principle as for a frame house. The studdings were fluted out on each side and concrete was poured between. After the framework had



Applying Stucco with Centrifugal Gun

been removed a very thin coat of plaster was applied to the exterior surface. Evidently this plaster was put on before the timber had absorbed all the dampness it was possible for it to absorb and as a consequence the plastering cracked opposite each studding. It was decided to cover the timbers with a coat of stucco. The walls were completely cleaned of all dirt and foreign matter and were wet by means of a high pressure hose. This was done 24 hours before apply-

ing the cement mortar. The walls were again wet a few hours before the stuccoing was put on. These wettings saturated the timber so thoroughly that it was impossible for it to expand any more from the dampness of the stucco. Two machines were used in applying the stucco. Each machine had an operator at 70 cents per hour and a helper at 45 cents per hour. In addition one man at 45 cents per hour was employed in mixing the material. The labor cost of applying the stucco was 15 cents per square yard. The sand cost \$3.00 per cubic yard or 2 cents per square yard of stuccoed surface; the cement cost \$3.20 per barrel or 6 cents per square yard of surface. The total cost of the finished job was therefore 23 cents per square yard.

Concrete Shaft and Tunnel Linings Increase Economy of Mine Operation

When the shaft of a mine is out of commission from any cause, the mine is temporarily out of business. The same is almost true of mine haulage ways, for no matter what the capacity of the shaft or shafts, maximum output cannot be maintained unless material mined can be delivered at the landings and the shafts kept working to capacity. Before being taken



Concrete Lined Hoisting Station

up the shaft, material must go through main haulage ways and any interference to efficient operation in these passages not only diminishes output but stops the working of that portion of the mine served by the haulage way in question.

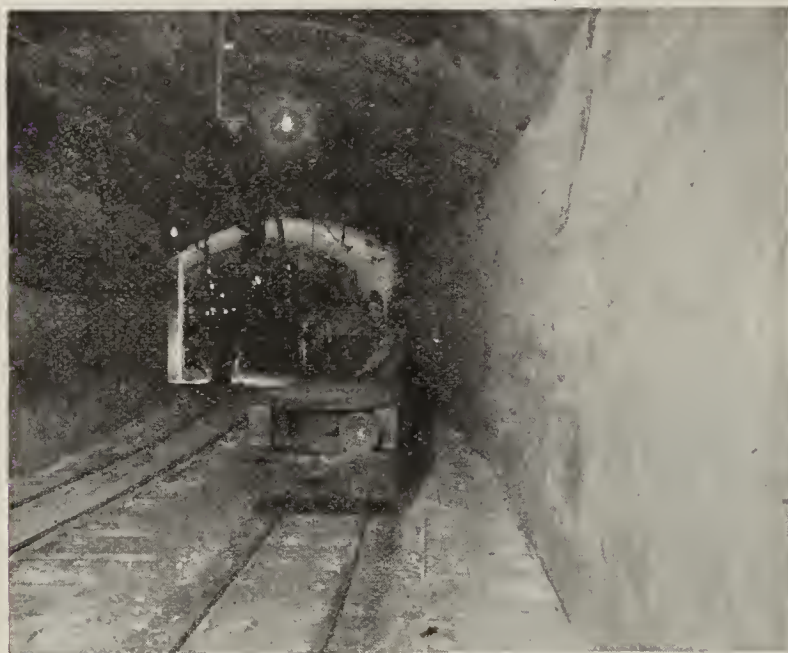
Maximum efficiency in operation depends greatly on uninterrupted shaft and main haulage ways and the first and fundamental principles of safety require that these vital outlets be as proof against obstruction by debris or closure by fire or caving as it is possible to make them.

Concrete lining provides the necessary protection against suspension of operation from fire or other causes. The shape of the concreted main haulage way shown in an accompanying illustration is such as to make available for actual use the maximum portion of the total section of the tunnel excavation. The view shows clearly the important advantages of a concrete

lining. Contrast this picture with the other, showing the same passageway timbered. These views are of one of the main haulage ways of the Ray Consolidated Mining Co., at Ray, Ariz., and illustrate "before and after" using concrete. The work was done by the Foundation Co., of New York, which makes a specialty of concrete in mines.

Until the timbering had been replaced by concrete, the likelihood of accidents due to insufficient clearance and to other possible causes was great. The concrete lining has done away with all obstructions and danger attendant upon the timber construction.

Method of placing concrete linings at the time of tunnel or shaft driving are varied but have been so



Mine Tunnel Lined with Concrete

developed that the work may be conducted with every certainty that the lining will progress and keep up with the tunnel or shaft driving without interference with other work. Even when timbering is replaced by concrete, the work may be done with a minimum of interference with operation of haulage ways.

Now that production of most metals and coal has become more important than ever, greater attention should be given to developing mine workings with every regard for efficient operation and safety.

First Concrete Oil Barge

Oil tank steamers and oil barges are urgently needed to transport supplies of fuel oil, gasoline, etc., overseas.

The first concrete vessel launched July 27, by the



The "Socony," First Concrete Oil Tanker Built for the Standard Oil Company

Fougner Concrete Shipbuilding Co., Inc., at its shipyards on Flushing Bay, New York, was also the first reinforced concrete barge for carrying oil in bulk to be launched in America. It is 98 feet long, 32 feet beam and 9 feet 9 inches deep amidships. It draws 3 feet 10 inches light and 9 feet with a cargo of 370

tons. Bulk oil is carried in 6 center and 2 wing compartments which have been oil-proofed by a special process. Eight-inch cast iron pipe lines lead to each compartment and the oil pump is located in a concrete pump room aft. The barge is also equipped to carry deck cargo. The deck is fitted with cast iron pitts, chocks and cleats to conform to the requirements of the Standard Oil Co., of New York, which owns



Reinforced Concrete Oil Barge "Socony 200" Ready for Launching

the barge. The Fougner Company has six sets of ways in operation at its Yard No. 1, where other concrete vessels are now building. Ways are also completed and work in progress at its Yard No. 2, which is nearby, for the construction of the first 3,500-ton deadweight concrete ship which the company is building for the Emergency Fleet Corporation. Herman Fougner is president of the company, the offices of which are at 50 Pine Street, New York.

Hydrated Lime in Concrete Roads

The following paragraphs are extracts from a letter by G. W. Hutchinson, testing engineer (Delaware State Highway Department), in which the results of his investigation are reported to Charles M. Upham, chief engineer. These extracts give information that careful engineers desire to have in studying the results of any investigation.

"The specimens were 6x12-inch cylinders and were made at the same time the concrete was being placed upon the roadbed. A chute mixer was used. The cylinder form was filled by holding it under the chute and deflecting the flow of concrete from the road into the form. All specimens of one mixture were taken from the same batch in the mixer.

"The specimens were not tamped, but were struck off on top and then were covered in order to protect them from the rays of the sun, this being identical with the treatment given the road. After being covered for 24 hours they were buried at the side of the finished concrete road, and at the time when moist earth was thrown on the road the specimens were included under this covering. They were left in place until they were 6 months old and received the same treatment as the road during this period and then taken to be broken.

"As the tests were started in November, it will be seen that the specimens were subjected to the fall, winter and spring periods.

"Consistency of the mixture was determined by the inspector and myself in accordance with our ideas of an ideal working consistency. The amount of water was not measured, as it was not practical under the circumstances, but the same consistency was maintained during the mixing by the agreement of opinions of the man running the mixer, the inspector and myself; that is, the specimens were poured when the consistency was unanimously agreed to by the three

parties as being the same as that of the previously made specimens."

Results of Test

At the end of the 6 months' period the specimens were removed to the laboratories of the Henry S. Spackman Engineering Co., Philadelphia, for breaking under compression.

Compressive Strength

Percentage of hydrated lime based upon the weight of portland cement in the mixture:

0% lime Lbs. per sq. in.	2½% lime Lbs. per sq. in.	5% lime Lbs. per sq. in.	7½% lime Lbs. per sq. in.
3108	2908	3596	3514
2203	3640	4381	5092
2529	3476	3473	4498
2613 avg.	3341 avg.	3816 avg.	4368 avg.

In breaking under compression, it was noted by the laboratory that *failure of the coarse aggregate occurred in every case.*

The State Highway Department of Delaware has made good progress on the problem of securing the highest practical field strength of concrete, and at the same time having a mixture of such workability as to permit its being economically placed, through the introduction of hydrated lime.

The most important development that has occurred recently in connection with the use of cement is that strength of concrete is governed almost entirely by the

that the contractor generally uses too great a quantity of water. The engineer realizes that as the quantity of water increases, the strength of the concrete decreases; so, in order to protect himself against too great a decrease, he insists that the concrete be placed with the minimum amount of water that will permit reasonably easy handling. This minimum amount of water is usually not sufficient to satisfy the contractor, because he realizes that with slightly larger quantities of water the material can be handled with less labor.

Hence these two opposing factors govern to a great extent the strength actually obtained in the finished concrete and the logical solution of the problem is to introduce such methods as will reduce the water content to a minimum and meet the objection of the engineer, and at the same time improve the workability of the mixture to meet the objection of the contractor. Such method has been followed by the State Highway Department of Delaware with the results as indicated by the foregoing. The proportions of the mixture used by the Delaware State Highway Department in all of its road construction are 1:2:4.

Statements have been made from time to time by concrete investigators that only a small proportion of the cement used in field concrete hydrates in such manner as to be of value and that the balance of the cement is drowned by excess water.

One of the foremost concrete investigators of the country sets forth a new method for governing the strength of concrete. His experiments indicate that within very wide limits concretes of identical strength can be made irrespective of the ratio between cement and aggregates, provided the ratio between water and cement is kept constant. Since, however, workability is the criterion which determines the minimum amount of water which can be used in a practical mixture, the range of the cement aggregate ratio is restricted.

It is evident from both of these theories that if some material could be introduced into the concrete at the time of mixing and placing which would impart workability to the mixture with a smaller percentage of free water, a distinct improvement in the strength of the concrete would be effected.

That hydrated lime will improve the workability of mortar and concrete is a well-known and generally accepted fact, and since hydrated lime is hygroscopic in nature, it will reduce the free water content in direct proportion to the amount present in the mixture.

One may conclude after studying the curve that the increase in strength was caused in part by the hydrated lime improving the workability of the concrete, and, as larger percentages of lime were used, decreasing the free water content of the concrete. This reduction of the free water content would in all probability have much the same effect as a reduction of mixing water and at the same time the hydrated lime would, through its hygroscopic property, retain water for the later hydration of the cement, releasing this water slowly to the cement and offsetting the loss of evaporation or drying out.

Value of the Test

These tests are of unusual interest because of the fact that they were conducted under actual working conditions, the test specimens being taken directly from the concrete as it was being placed. The results, therefore, give a true indication of the actual strength of the concrete in the finished road.

Those who have closely studied the action of hydrated lime in concrete have been frank in stating that the function of hydrated lime is to improve concrete under field conditions, a result not so apparent under

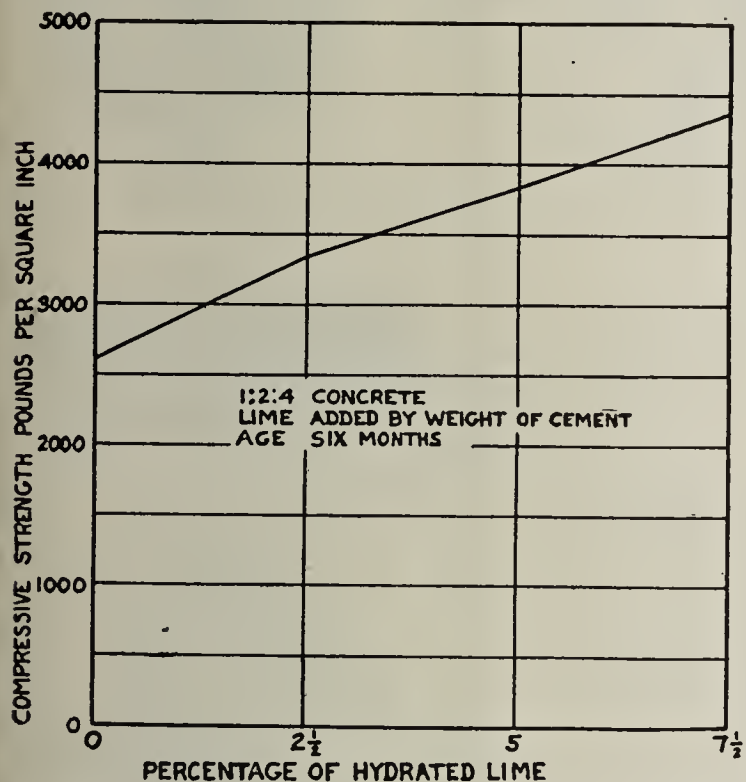


Diagram showing the effect of hydrated lime on the strength of concrete specimens stored under actual working conditions. The percentages of hydrated lime shown were by weight of the cement content, the 7½% being equivalent to 7½ lbs. of hydrated lime added for each bag of cement. From field tests made by the State Highway Department of Delaware.

volume ratio of water to cement. Generally speaking, a ratio of 0.4 to 1 gives maximum strength, while a ratio of 2 to 1 gives practically no strength. It is well known that a mixture containing just sufficient water to develop maximum strength is of too dry a consistency to permit being worked economically; so it has become the custom of engineers to permit the use of larger quantities of water in order to allow the contractor to place the mixture in the forms without employing too much labor.

The difficulty with this compromise, however, is

laboratory conditions. The reason for this is that concrete specimens as made in the laboratory are prepared under most favorable conditions of workmanship and a drier consistency than concrete as placed in the field. In addition, it is the usual custom to store laboratory specimens under water, in a damp closet, or in damp sand. Under these conditions the specimens have an opportunity to develop maximum strength, so that such specimens are practically perfect, and, other things being equal, the possibility for improvement is limited to the personal equation of the operator.

In field practice the conditions are entirely different; the concrete is not so carefully proportioned or mixed; the water is not so carefully regulated, and the conditions of storage are not so favorable. The possibility for improvement of field practice, therefore, is governed not so much by the personal equation alone as by the introduction of a material which exercises a mechanical influence over the concrete at the time of mixing, handling and placing, and which permits these operations to be carried out with the use of a minimum quantity of free water.

Loading Rock by Auto Crane

An interesting method of loading rock is employed by A. Courchesne of El Paso, Texas, at his limestone quarries near that city. The stone is broken out by means of two large tripod drills and three jackhammer drills, all operated by compressed air. The pieces of rock are piled into skips and are elevated and dumped by means of a Byers auto crane, manufactured by the John F. Byers Machine Company, 204 Sycamore street,



The Byers Auto-Crane Loading Crushed Stone in a Texas Quarry

Ravenna, Ohio, into motor trucks and wagons for haulage to the crushing plant, one-quarter mile distant.

In all 15 skips, each of $1\frac{1}{2}$ tons capacity, are used. In this way there always is a supply of rock ready for loading. The hauling is done by two $3\frac{1}{2}$ -ton motor trucks and three 3-ton back dump wagons. The hauling cost per ton by motor truck is 4 cents and by dump wagon 7 cents. The loading cost with the Byers auto crane is 2 cents per ton. The outfit has a capacity of 500 tons per day.

Chalk Concrete Building Blocks

From Concrete and Constructional Engineering.

In the March issue of this journal last year reference was made to a form of concrete block construction invented and carried out in France by Captain Quick, R. E. Since that time a great advance has been made

in this type of construction, blocks of different forms have been employed, and the product has been applied to a variety of uses.

In this system, the concrete was composed of chalk and Portland cement. The original block intended for walls of the pier and slab type was hollow and measured 10 in. by 10 in. by 2 in. The composition of the concrete, both for piers and blocks, is one part Portland cement and four parts chalk. The chalk is first thoroughly ground in a mill, and then the proper proportion of cement ground in with it. The mixture may then be made into a slurry, poured into molds and allowed to set; or it can be molded in a substantially dry state under pressure when it is said to be ready for use almost immediately.

In addition to the hollow blocks, which are used in two sizes, 10 in. by 10 in. by 2 in. and 9 in. by 9 in. by $4\frac{1}{2}$ in., solid concrete bricks are made, 9 in. by $4\frac{1}{2}$ in. by 3 in. These are molded with the aid of a French hand pressure machine, the mixture being in a semi-dry state, and variously proportioned from 1:4 to 1:10. It is claimed that the concrete bricks thus produced, and in the manufacture of which unskilled labor only is employed, are equal to the best facing brick made in this country, and at a cost well under that of the cheapest burnt brick. The buildings in the erection of which these blocks have been used have withstood the rigors of three winters, and we understand have shown themselves to be unaffected by frost or rain; experiments, too, have been conducted with a view to ascertaining the fire resisting properties of the material, which, we are informed, were found to be very high.

As would be expected from the nature of the ingredients, this kind of concrete has a very fine texture, and it is said that when green it can be carved with ease.

Railroad Reconstruction and Expansion Calls for Concrete

A study of the distribution of expenditures approved by the railroad administration for 49 railroads having an aggregate mileage in excess of 150,000, shows that over \$64,000,000 is being spent for shop buildings, engine houses and similar betterments. This indicates that the railroad administration fully realizes the very great importance of keeping up and increasing, if possible, the efficiency of this great arm of transportation.

One of the most important structures on a railroad is the roundhouse—the “first aid” station for the prime motive power of the road. The work that is done in the engine house is of great importance in increasing the length of service of locomotives before they are put into the back shop for repairs, and the efficiency with which minor repairs such as are usually attended to in the roundhouse are made greatly increases the average total of locomotives constantly in service.

Engine houses are particularly subject to fire hazard. Fires are kindled in locomotive fire boxes preparatory to raising steam while the locomotive is in the roundhouse. In times of great demand for motive power, roundhouse men are busily engaged and while much of the fire hazard can be reduced by installing proper lighting systems and convenient waste containers and restricting as far as practicable the use of torches, the fact remains that no class of railway buildings suffers so frequently from fire as do engine houses. Such fires

THE COMBINATION OF DODGE

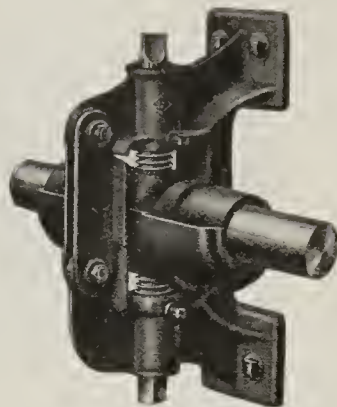
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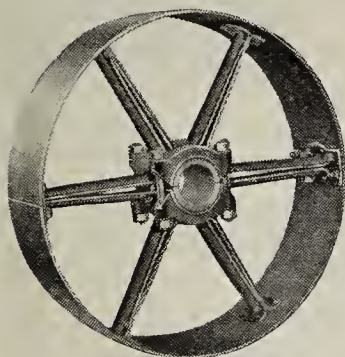
Dodge Adjustable Hanger (Drop Type) with Self-Lubricating Bearing.



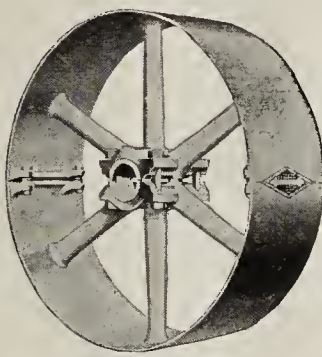
Dodge Adjustable Hanger (Post Type) with Self-Lubricating Bearing.



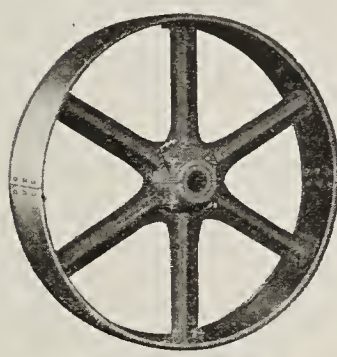
Dodge "Independence" Split Wood Pulley with Interchangeable Bushing.



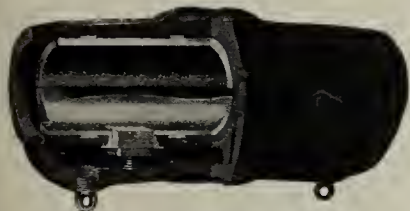
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Dodge "Standard" Split Pulley with Interchangeable Bushing.



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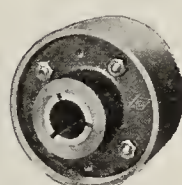
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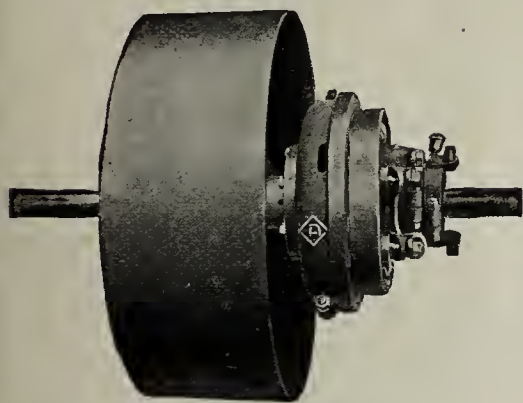
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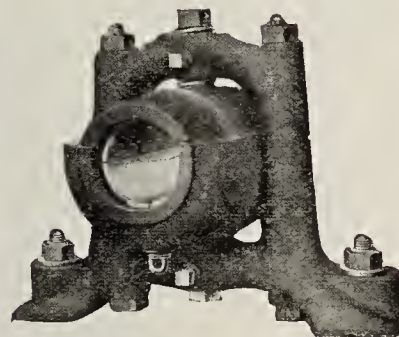
Dodge Keyless Compression Coupling.



Dodge Flange Coupling.



Dodge Split Friction Clutch as Used with Iron Pulley.



Dodge Adjustable Pillow Block with Self-Lubricating Bearing.

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Distributors of the Products of the Dodge Manufacturing Company

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are of a serious nature for reasons other than the loss occurring from the destruction of the building itself. The history of roundhouse fires indicates that in a great majority of cases a considerable number of locomotives inside the engine house are "dead" and must be allowed to go through the fire as best they can. The result is much damage to the locomotive, requiring a



Concrete Unit Built Roundhouse at Riverbank, Cal.

considerable period of time and outlay of money before it can be put into service.

Terminal facilities, shop buildings, bridges and similar structures of the railroad will no doubt come in for considerable expansion, rebuilding or replacement in the railroad administration's plan for bringing the roads up to required operating standards.

Gravel Plants of the Richardson Sand Company

Two gravel plants owned by the Richardson Sand Company of Chicago are located at Carpentersville, Illinois, and at Coleman, Illinois. Their combined capacity is 60 to 70 cars, of which the Coleman plant, here described, delivers from 25 to 30 cars, or about 900 cubic yards.

The gravel deposit lies in the valley of the Fox River and above water, so that it can be worked dry. The working face of the bank is about 40 feet.

Company, Chicago), which carries it to the top of the bin structure, about 85 feet high, where it is delivered to the screens.

The screens are cylindrical, 9x4 feet, of perforated steel, in sections. They are interchangeable, so that by arranging them in different combinations material can be graded in various ways to suit orders. The following sizes of perforations are used as needed: 2-in., 1½-in., 1¼-in., ¾-in., ⅜-in., ¼-in. These screens are specially designed and made to order and are used in such combinations as will produce maximum quan-



Coleman, Ill., Gravel Plant of Richardson Sand Co., Equipped with "Superior" Crushing Rolls

ties of sizes most in demand. A typical screen set may be assumed for producing the size known as No. 8, a mixed gravel from 1¼-inch to ⅜-inch in diameter; roofing gravel ¼-inch to ⅜-inch and sand from ¼-inch down.

Screen No. 1, 1¼-inch holes, would be used at the head of the line and screens out all material over 1½ inches and chutes it to a No. 3-D Gates breaker and a No. 4 McCully standard crusher set to make

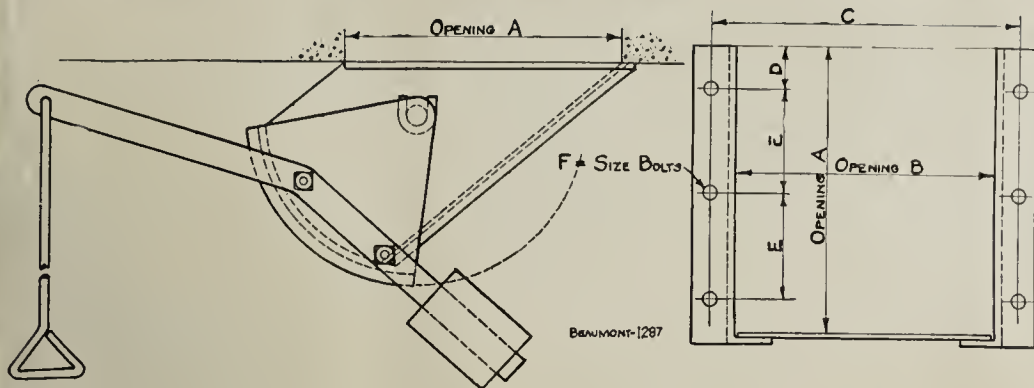


Carpentersville, Ill., Gravel Washing Plant of the Richardson Sand Co.

Material is dug with a steam shovel with 1½-yard dipper and loaded on a 25 cubic yard Rodger ballast dump car which is drawn by a 35-ton Vulcan locomotive to the screening plant about ½ mile distant, where it is dropped into a receiving hopper under the track. From the receiving hopper the material is fed to a 28-inch 8-ply Rexall double stitched conveyor belt about 300 feet long (furnished by the Imperial Belting

1½-inch stone, which is returned to the receiving hopper by a belt conveyor.

As the material enters the screens it is washed with quantities of water delivered by a 4-inch two-stage centrifugal pump (made by the Kingsford Foundry & Machine Works, Oswego, N. Y.), at the rate of 500 gallons per minute. The washing is continued throughout entire screening process.

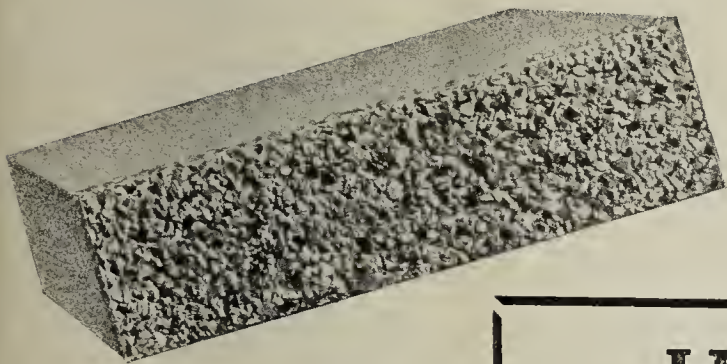


Lever Undercut Gate

An undercut gate should always be used for material containing large lumps, as an overcut gate will close down on a large lump and remain partly open, allowing the finer material to drain out. This gate is made for attaching to side of bins as well as to the bottom.

Other types of gates are shown in our Catalog 37. Write for it.

Beaumont Mfg. Co., 340 Arch St., Philadelphia, Pa.



The Improvement of a World Necessity

Do not overlook the opportunity and profit it offers you.

Helm Granite Brick

Granite Faced Helm Brick

Helm pressed cement brick are faced with nature rock facings more beautiful than any clay faced brick on the market. These facings include granite, marble, feldspar, mica and other crystalline aggregates. Also with permanent mineral colors in reds, browns, buffs and other tints. The process is so simple expert labor is not required.

The manufacture of brick is as old as civilization—the demand for brick is as certain as day and night. Practically every building means a brick sale—the total brick business in your locality is large and profitable. Make Helm brick and people will buy more brick from you than from anyone else—because Helm brick (plain or faced) is an improved brick. It is stronger, more durable, faster to lay and better looking. There is not a better business opportunity open in your town than the manufacture of Helm brick, and we assure you that you can easily make it a success. It is simply a matter of your making the start.



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It will not obligate you a penny's worth to let us show you the advantages of Helm brick and the large profits that are being made in its manufacture. Let us go into the matter with you very carefully.

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Helm Machines
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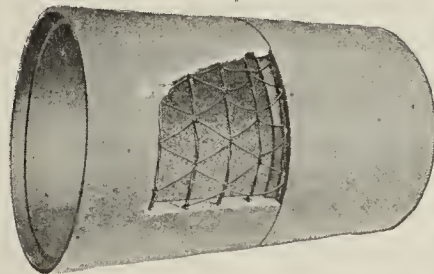
Gentlemen:—Please send me full particulars about the Helm Brick and Block Press and the Products it makes.

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Steel Forms for Concrete Culverts

Used and recommended by state engineers everywhere as standard for construction of sewers, culverts, flumes, drains, tile and similar work. They save time, trouble, man-power and money. Any kind of reinforcing may be used.



Northwestern Steel Forms are made in standard sizes—round or elliptical. Write for Bulletin 29.

Northwestern Steel & Iron Works
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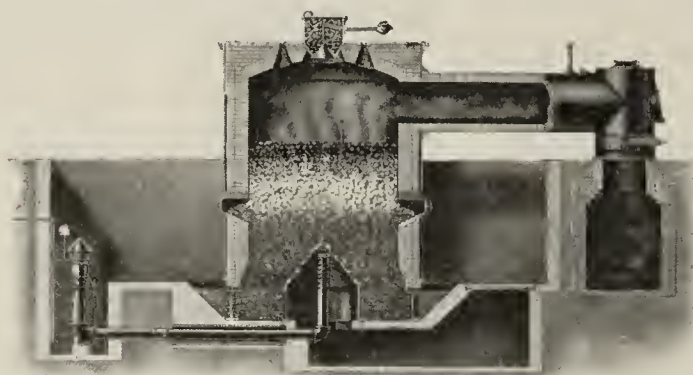
The gravel which passes the 1½-inch holes is caught in a steel flume and delivered to a screen with ¾-inch perforations, which removes the gravel above ¾-inch and passes it to the storage bins. The fine material is passed to a third set with ¼-inch perforations, which removes the sand and delivers the roofing gravel to storage. The sand is passed to a sand separator, from which it reaches proper storage. A 2-ton locomotive crane, manufactured by the Link Belt Company, Philadelphia and Chicago, and three Rodger Ballast dump cars, was recently added to their equipment.

Pressure Gas Producers

A type of hand-stroked pressure gas producer, which has been used quite extensively in the ceramic industry, is now being introduced for other purposes by the International Clay Machinery Company, Dayton, Ohio. It is adaptable for use with dryers for agricultural limestone for calcining lime and for other purposes in the rock-products field.

The operation is on the pressure principle, the producer being of the updraft type with a steam jet blower that supplies steam and air to the combustion zone of the fuel bed. The reaction of the air and steam with the coal in the fuel bed of the producer, gives a mixed gas known as producer gas.

The producer is composed of a steel shell supported by a cast-iron ring base, which is supported by cast-iron columns rising from the ash pit. The cast-iron ring projects into the ash pit to the extent that when the pit is filled with water, a waterseal is produced. The top of the producer, or cap, supports a hopper for the feeding of fuel, while the gas is taken off by a firebrick-lined neck extending horizontally from the producer near the top. The producer shell is lined with firebrick and the top cap is made of firebrick block or standard shape brick. The shell is fitted with side



International Pressure Gas Producer

poke holes, peep holes, and clean out doors designed for minimum labor of operation.

The hopper is a simple charging mechanism of the double door type. The fuel is placed in the hopper, the top door closed and the conically shaped bell or bottom door dropped. The shape of the bottom door causes uniform distribution of the fuel. The hopper is proportioned with the idea of holding sufficient coal for a certain operating period. This makes the charging operation more mechanical. Little gas can escape, owing to the closing of the top door before the bell is dropped.

It is claimed that an efficiency of 89.8 per cent in ordinary operation with only 0.4 per cent loss of carbon in the ash, is very uncommon operation.

International gas producers are made in 6 ft., 7 ft., 8 ft., 9 ft., and 10 ft. sizes. (Sizes refer to internal diameters.) Where conditions permit, the installation of the smaller sizes, such as 6 ft. and 7 ft., is advocated.

Experience has shown that the smaller diameter producers are operated more easily and with less labor on poor grades of fuel than are the larger sizes. Furthermore, the above two sizes can be pushed to a greater overload capacity in proportion to their diameters than can the larger sizes.

Road Building

Road building is one of the most purely patriotic occupations Americans can engage in. France held Verdun by means of her good roads. The railroads to that fortress was shot away. Its place was taken by 14,000 motor trucks, which kept the front supplied with men and munitions. If we fail to build roads the day may come when we shall repent of our remissness. "Too late, too late," will be the cry.

The Greenville Gravel Company, operating a pit near Mechanicsburg, Ohio, has announced a ten cents advance in wages, making the wages of its employees 50 cents an hour, effective next pay day. A man putting in full time can earn \$5.50 a day or \$150 a month.

The company is classed as B1 in the essentials and has orders for 150 cars a day with only labor capacity for 50 cars. The company's payroll runs about \$9,000 a month.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

Of Cement & Engineering News published Monthly at 672 Transportation Bldg., Chicago, Ill., for April, 1919.

State of Illinois, County of Cook, ss.

Before me, a Notary in and for the State and county aforesaid, personally appeared J. F. Waldron, who, having been duly sworn according to law, deposes and says that he is the Managing Editor of the Cement & Engineering News and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, William Seafert, 672 Transportation Bldg., Chicago, Ill.; Editor, William Seafert, 672 Transportation Bldg., Chicago, Ill.; Managing Editor, J. F. Waldron, 672 Transportation Bldg., Chicago, Ill.; Business Managers, J. F. Jamieson, 672 Transportation Bldg., Chicago, Ill.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock). Wm. Seafert, 672 Transp. Bldg., Chicago, Sole Owner.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

J. F. WALDRON,

Signature of Editor.

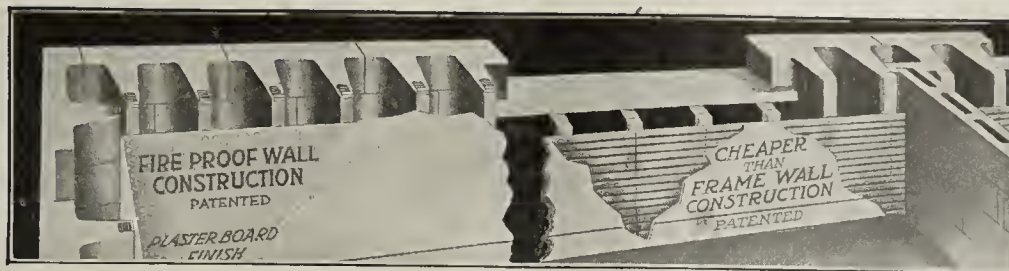
Sworn to and subscribed before me this 27th day of March, 1919.

(Seal.)

FRANK W. McVICKER,

My Commission expires March 27, 1920.)

SYNSTONE PRODUCTS

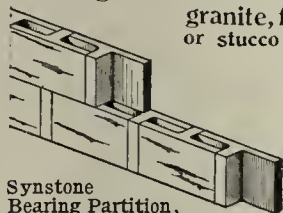


This SYNSTONE SINGLE WALL is being used for rebuilding Halifax.

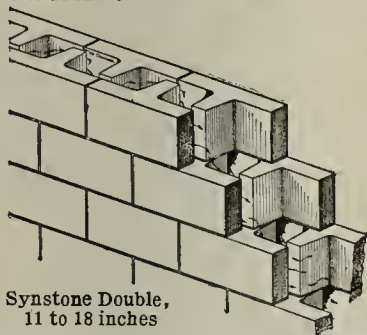
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Costs Less Than Any Other Practical Wall Construction

Wet process, making real Concrete walls, impervious to heat, cold and moisture, fireproof and everlasting. Hollow Concrete Walls, stronger than brick, faced with beautiful natural material—crushed granite, feldspar, marble or sandstone, with all the sparkle and life of natural stone. Brick or stucco facings if desired. A wet, soggy mixture, 1 cement, 2½ sand and small gravel, 4 parts or 1" stone or gravel, producing stone withstanding 3000 lbs. pressure per sq. inch and 1700 degrees heat for one hour without injury. Complete machinery making all walls and all shapes and sizes of blocks required for them, by simply hooking on another core. Every block perfect with true edges. Unskilled labor, one, two or three men, capacity 50 blocks or 100 sq. feet per hour.



Synstone Bearing Partition, 3 to 12 inches



Synstone Double, 11 to 18 inches

SYNSTONE SINGLE WALL—½ as much material and labor as in any other concrete wall



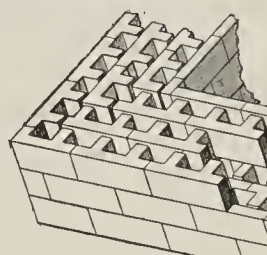
SYNSTONE MACHINE

Send for catalog.

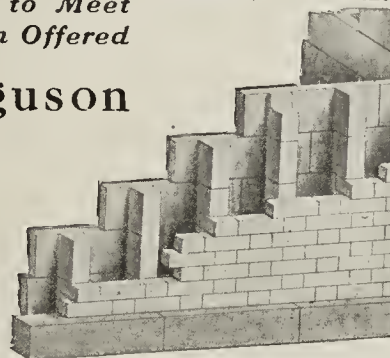
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Lock Seam Pipe with the smooth inside surface, having already

furnished large quantities for Potash Recovery plants, we are able to give especially careful attention to the construction of this class of Pipe.

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STILL MORE BUSINESS

"THAT POLK SYSTEM JUNIOR machine is proving to be a wonder as a business getter. Builds garages, well-houses, corncribs and water tanks as well as silos. Four-inch-wall machine, you know, that builds a monolithic concrete silo which competes dollar-for-dollar with the good grade of wood-stave types.

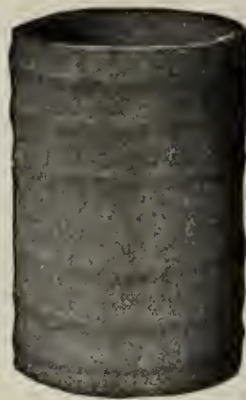
"It is cheaper than other concrete silo machines and it gets the low and medium priced business, which ordinary machines can't touch. Besides, it builds those other circular concrete buildings that are also greatly in demand.

"Yes, the company will promptly send you full particulars."

Polk Genung Polk Company

404 Great Northern Building
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Drain Tile Sales Will be Larger Than Ever

The farmer is urged to still greater crop production; not a square foot of land can be left uncultivated. A huge amount of drainage will mark next year's activities; drain tile will be at a premium.

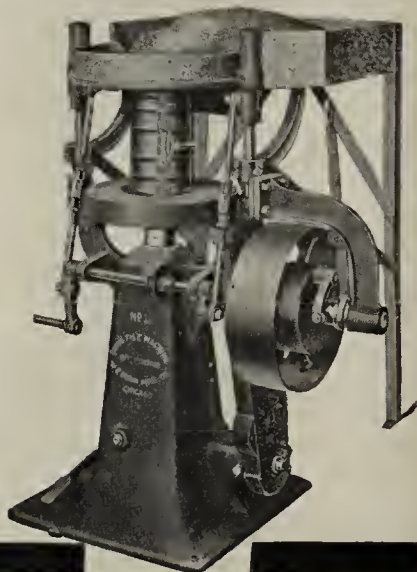
Every concrete products plant should get in shape to handle the biggest spring business in drain tile ever known. Almost every plant is capable of making tile at very little additional outlay. We post you on manufacturing and furnish all equipment.

Dunn—the Standard Machine

Ninety per cent of high grade tile is made on the Dunn machine, because it absolutely guarantees a strong, lasting and superior product. Double packing and double troweling are features only of tile that are Dunn-made. Easily better than clay tile, and can be sold in competition with it.

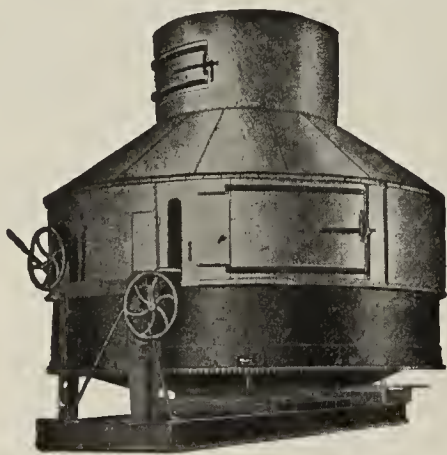
The Dunn machine makes manufacturing easy and highly profitable, and is sold at a lower price than any other machine of its capacity. Write for bulletins on the machine and the business.

W. E. Dunn Mfg. Co.
414 24th Street
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Hydrating Plants Equipped With The CLYDE LIME HYDRATOR

Are an Assured Success



Clyde Hydrator with Hood
"The common sense way"

The modern Hydrating Plant of the Clinchfield Portland Cement Co., at Kingsport, Tenn., illustrated and described in the February, 1919, issue of Cement & Engineering News, is equipped with the Clyde Hydrator.

This up-to-date and successful Hydrating Plant was placed in operation last summer. It was built and designed by Richard K. Meade & Co., Engineers, Baltimore, Md.

The Clyde Hydrator has become standard equipment. It always turns out a uniform product.

The Clyde makes perfect hydrate of either high calcium or dolomite lime. Low in first cost, simple to install, economical to operate.

H. Miscampbell :: Duluth, Minn.

Patentee and Sole Manufacturer

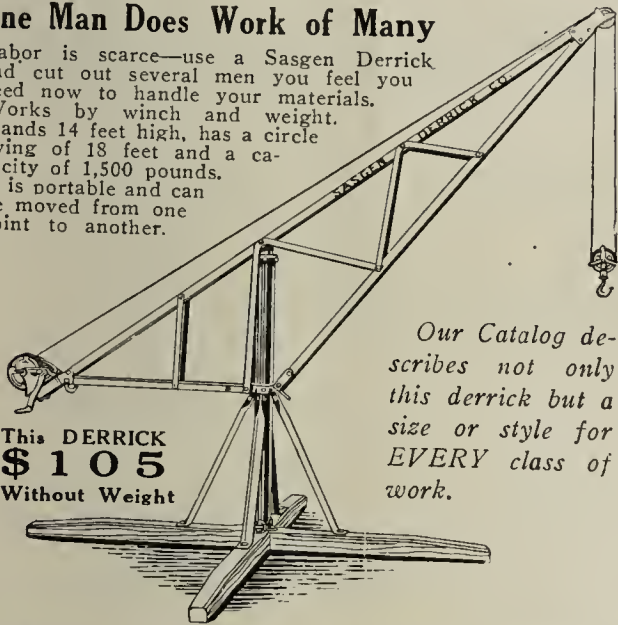
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Load and Unload With a Sasgen Portable Derrick

The Sasgen Circle Swing Counterweight Derrick cuts costs, labor and time loading or unloading material from cars or wagons.

One Man Does Work of Many

Labor is scarce—use a Sasgen Derrick and cut out several men you feel you need now to handle your materials. Works by winch and weight. Stands 14 feet high, has a circle swing of 18 feet and a capacity of 1,500 pounds. It is portable and can be moved from one point to another.

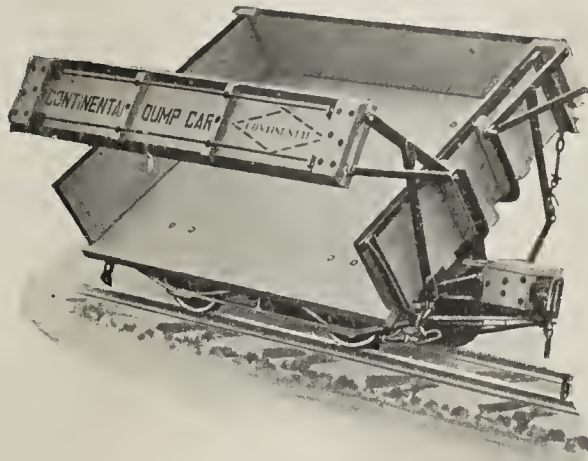


This DERRICK
\$105
Without Weight

Our Catalog describes not only this derrick but a size or style for EVERY class of work.

Sasgen Derrick Co., 3117 W. Grand Ave., Chicago

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A BILITY to stand up under the most gruelling tasks—under the most severe strains—has made the Continental name a by-word across the nation.

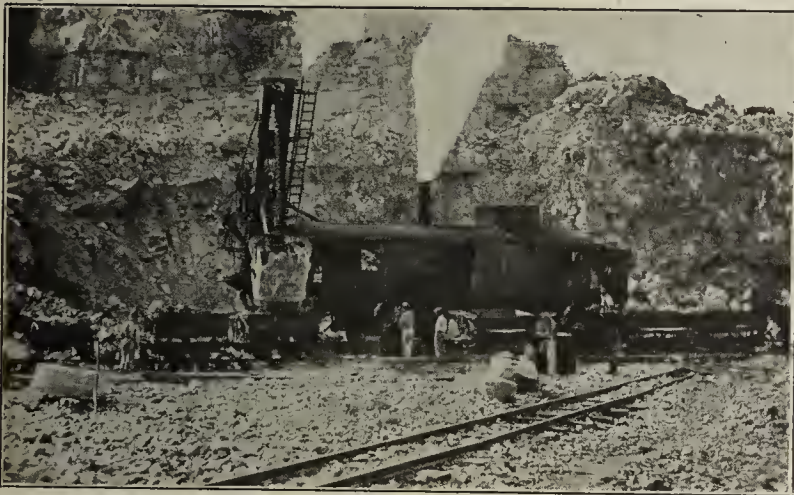
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are noted for correct design, sturdy construction, highest grade of materials and workmanship, and they incorporate many new features not found in other cars.

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Continental Car Co. of America, Inc.

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Western Dump Cars for Stone Quarries

We Build Them Strong. They Are Made of the Very Best Material

This interesting picture taken in an Arkansas stone quarry. One mule draws a 2-car train to the crusher. One of many industrial uses for Western Dump Cars. They are used for hauling all kinds of material in all parts of the world.

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Western Wheeled Scraper Co.
AURORA, ILL.

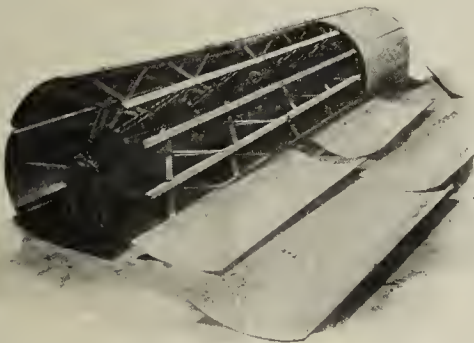
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Adjustable to 39 different diameters, of any and all lengths. Easily portable, quickly set in place, easily withdrawn, nests in small storage space, cuts concrete culvert costs wherever used. Roller bearings—nothing complicated.

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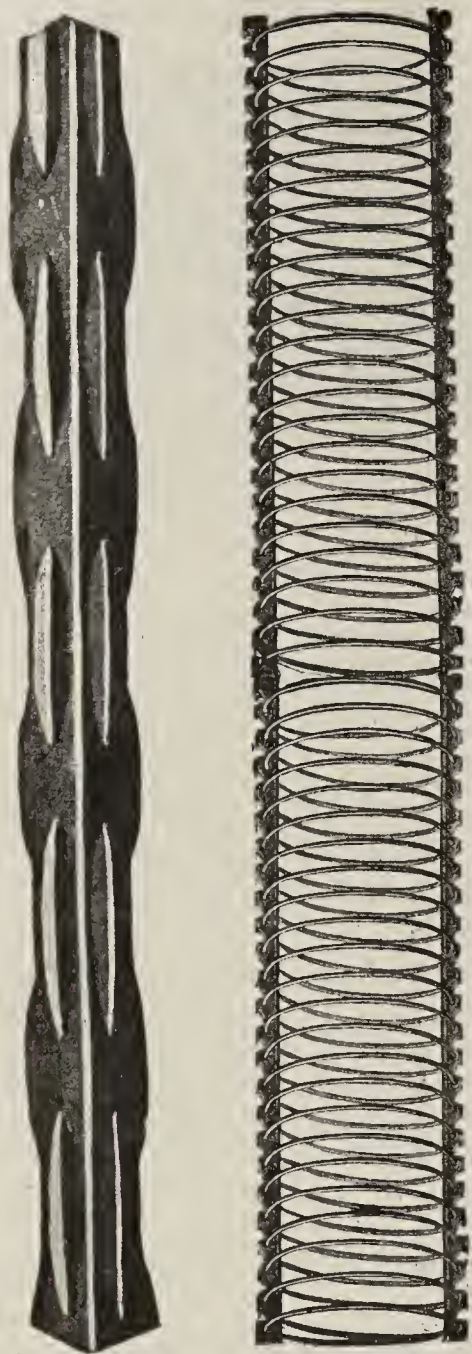
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“Bars on the Job Ready for Your Men”

Delay, caused by the failure to have your reinforcing material on the job not only throws out your calculations but also the schedule of every other contractor on the job.

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Service insures direct shipments of reinforcing steel from our Chicago warehouse, which is located within easy teaming distance of the loop and makes delivery when material is needed.

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Three grades: open hearth steel (new billet stock), "medium" and "hard" grade, and rail carbon steel (re-rolled). Both theory and practice agree on the design. Rounded corners prevent splitting of the concrete. Bending, fabricating and setting are easily done with these bars.

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Laclede Bars for Reinforcing Concrete



Many buyers now take advantage of facilities at mill by ordering bars cut to length, bent to shape, and tagged—ready for placing.



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We can meet your Reinforcing Steel Requirements. This means not only quick shipment from the mills but co-operative service for rapid transportation. If you want to know just what your exact cost will be, send us the Blue Prints and we will give you a lump sum bid on all the steel sheared to lengths, bent to specifications and delivered to the job.

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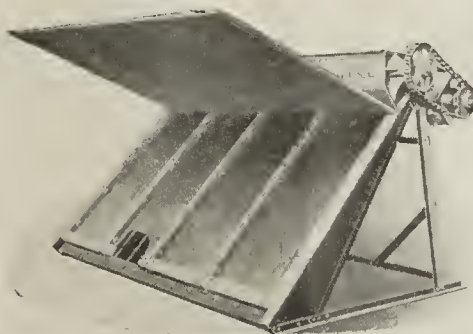
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Durability
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Cement Mill Equipment

Link-Belt labor-saving devices have earned wide adoption in the cement and allied industries, where quality and the ability to withstand corrosive and abrasive action are essential to long life. They are backed by nearly a half-century of experience in the design and manufacture of elevating, conveying and power transmitting equipment and accessories. We carry large stocks of accessories and parts, and are equipped to give quick service.

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We Also Make

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Write for Catalogs
Place X in Square

Cordeau-Bickford Detonating Fuse

Used in This Successful Blast



225,000 tons recently shot in one blast in above quarry, owned by the Bethlehem Mines Corporation, Steelton, Pa.

FOR SAFETY AND EFFICIENCY

The Explosive Charges Were Detonated With

Cordeau-Bickford Detonating Fuse

In a blast of this magnitude consider the amount and value of the explosives used; add from 10% to 20% greater efficiency to your explosive by giving proper and complete detonation by means of Cordeau; add to this the safety features; and if you are not already using it, you will be interested in having a Cordeau booklet. Cordeau is a necessity to the far-sighted quarry owner.

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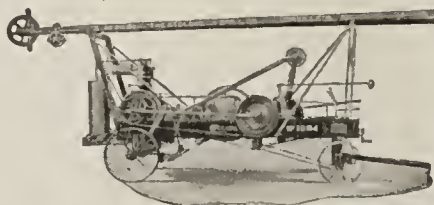
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FOR WATER PROOFING AND TO FACILITATE POURING CONCRETE



In these 51 concrete storage tanks, recently erected in Cedar Rapids, Iowa, by the Quaker Oats Co., there are approximately 12,500 cubic yards of concrete—1-2-4 mix. The walls are perfect cylinders, with no lips or bulged surfaces.

Hydrated lime was used for waterproofing and also to facilitate pouring the concrete and lifting the forms, owing to its lubricating properties. In mixing, 25 pounds of hydrated lime was put into each batch, which made the percentage of lime to cement a little over 8% by weight. The mixers used were of such size that three bags of cement could be used in each batch.

Considerable credit is given by the Leonard Construction Co. of Chicago to the lime. The statement is made that the lime gave the exterior surface a white and uniform appearance, and that the surface needed no subsequent coating. There were no joints where the concrete stuck to the forms and "lifted," as it does in many cases where the concrete is not of uniform mixture.

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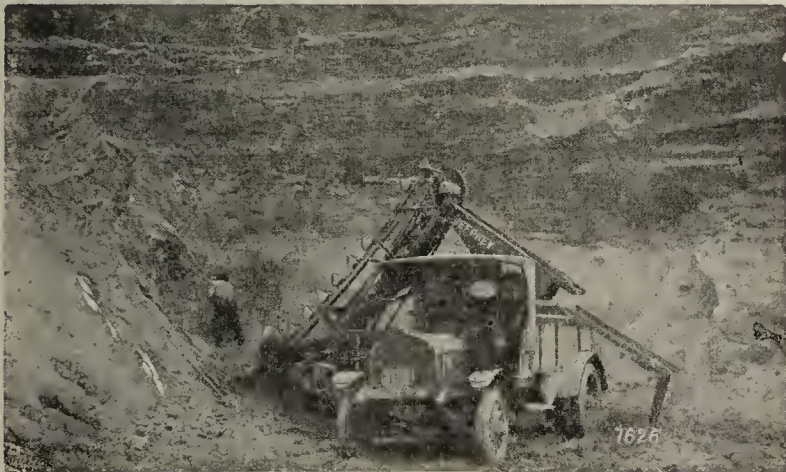
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CEMENT AND ENGINEERING NEWS

with which Gravel & Stone Magazine is incorporated

22 Quincy Street, Chicago.

(PUBLISHED MONTHLY)

William Seafert, *Publisher and Editor*

J. F. Waldron, *Advertising Manager*

R. M. McCully, *Business Manager*

Telephone, Harrison 5397

Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, \$1.00 per year; all
other countries, \$1.50 per year.
Single Copies 20c.

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Advertising copy or changes in ads. must be in this office by the 25th of each month, as hereafter our magazine will appear on the 5th of the following month

Advertising Rates Sent on Application

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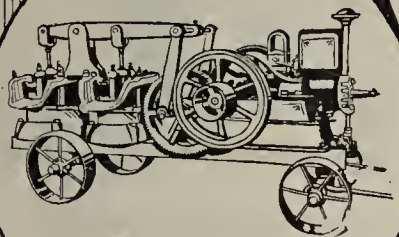
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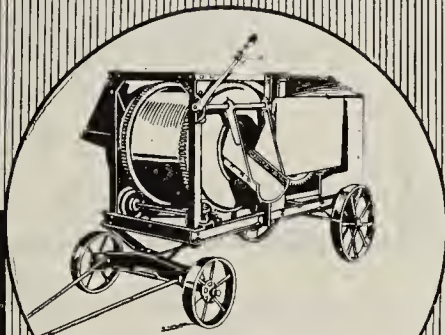
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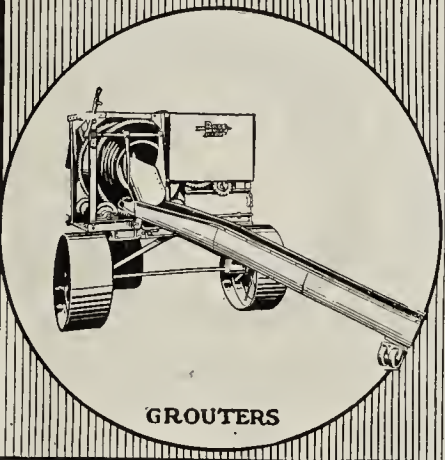
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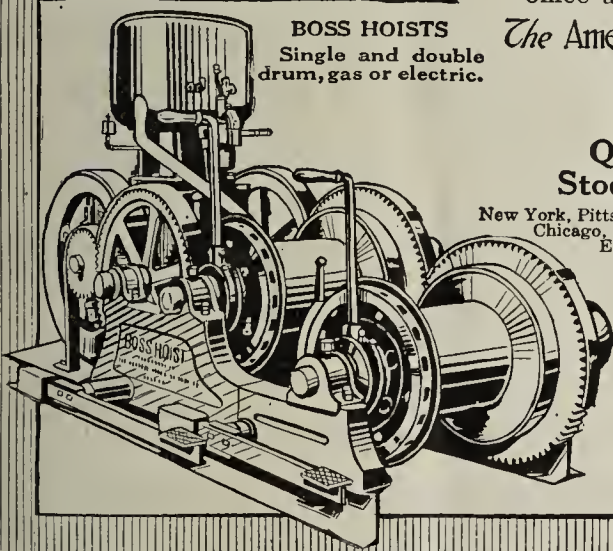
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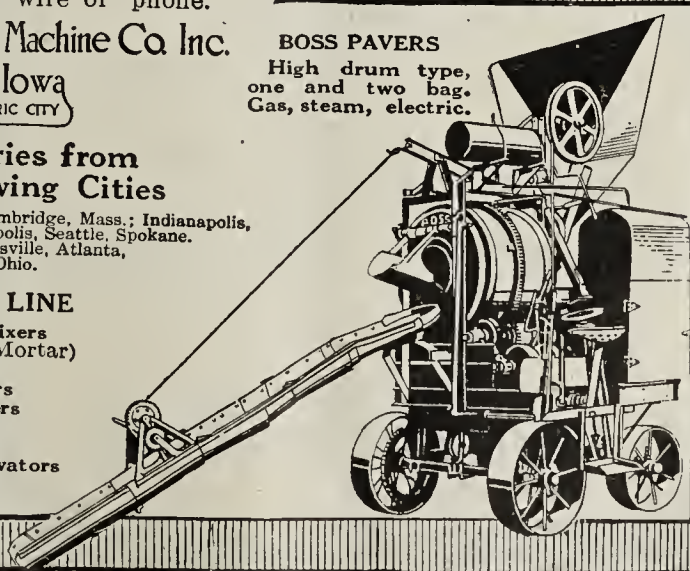


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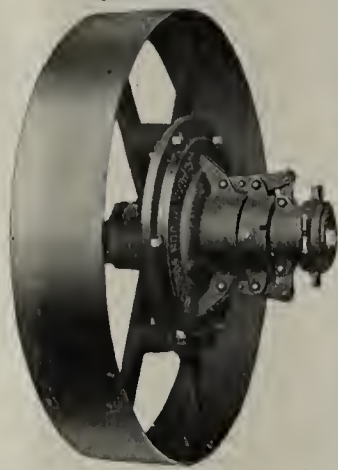
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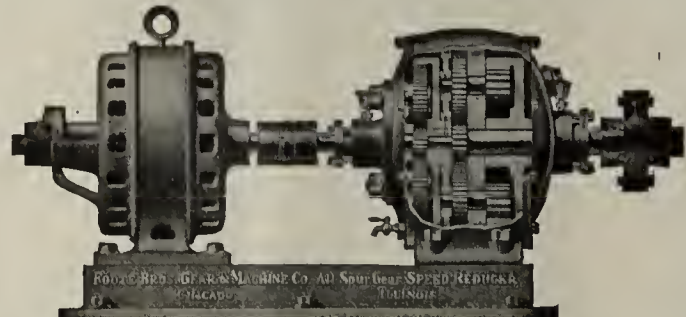
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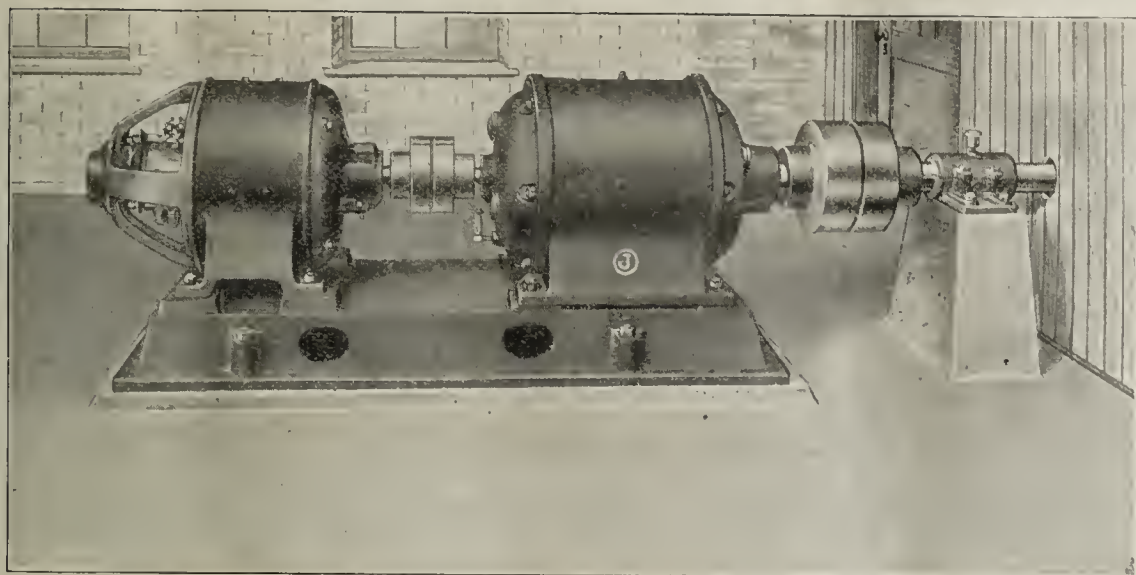
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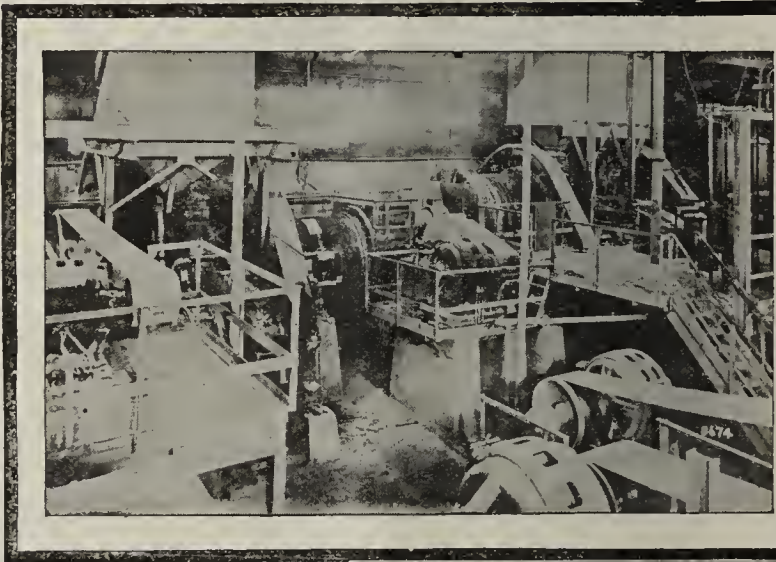
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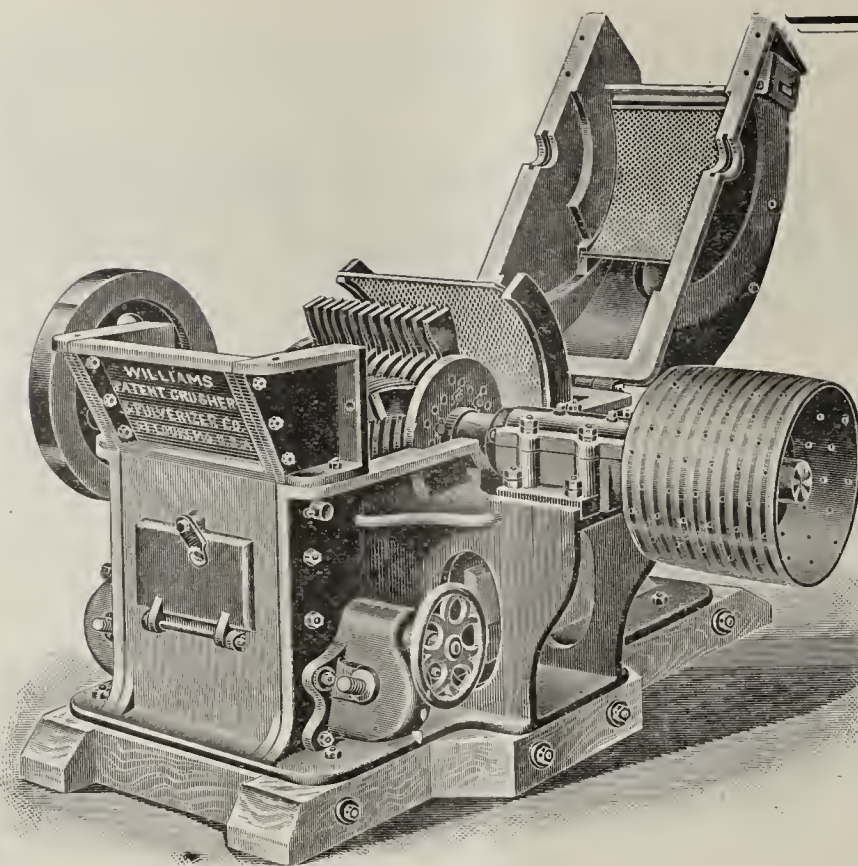
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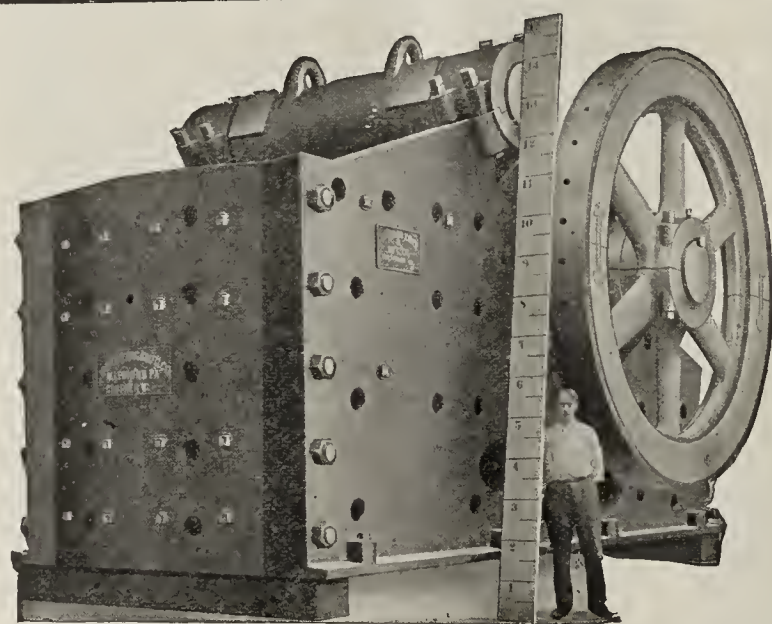
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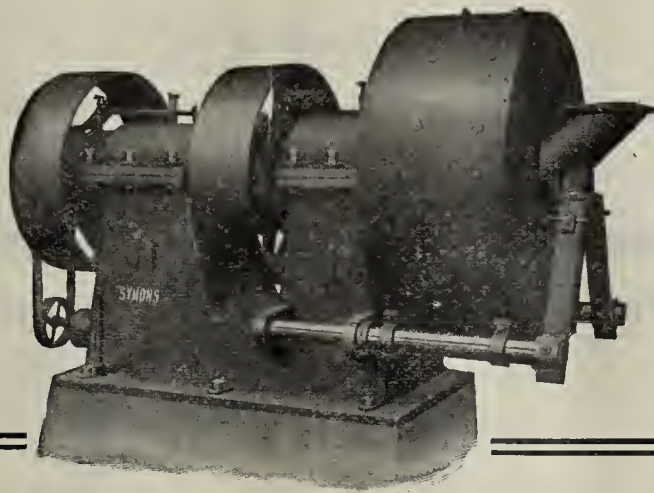
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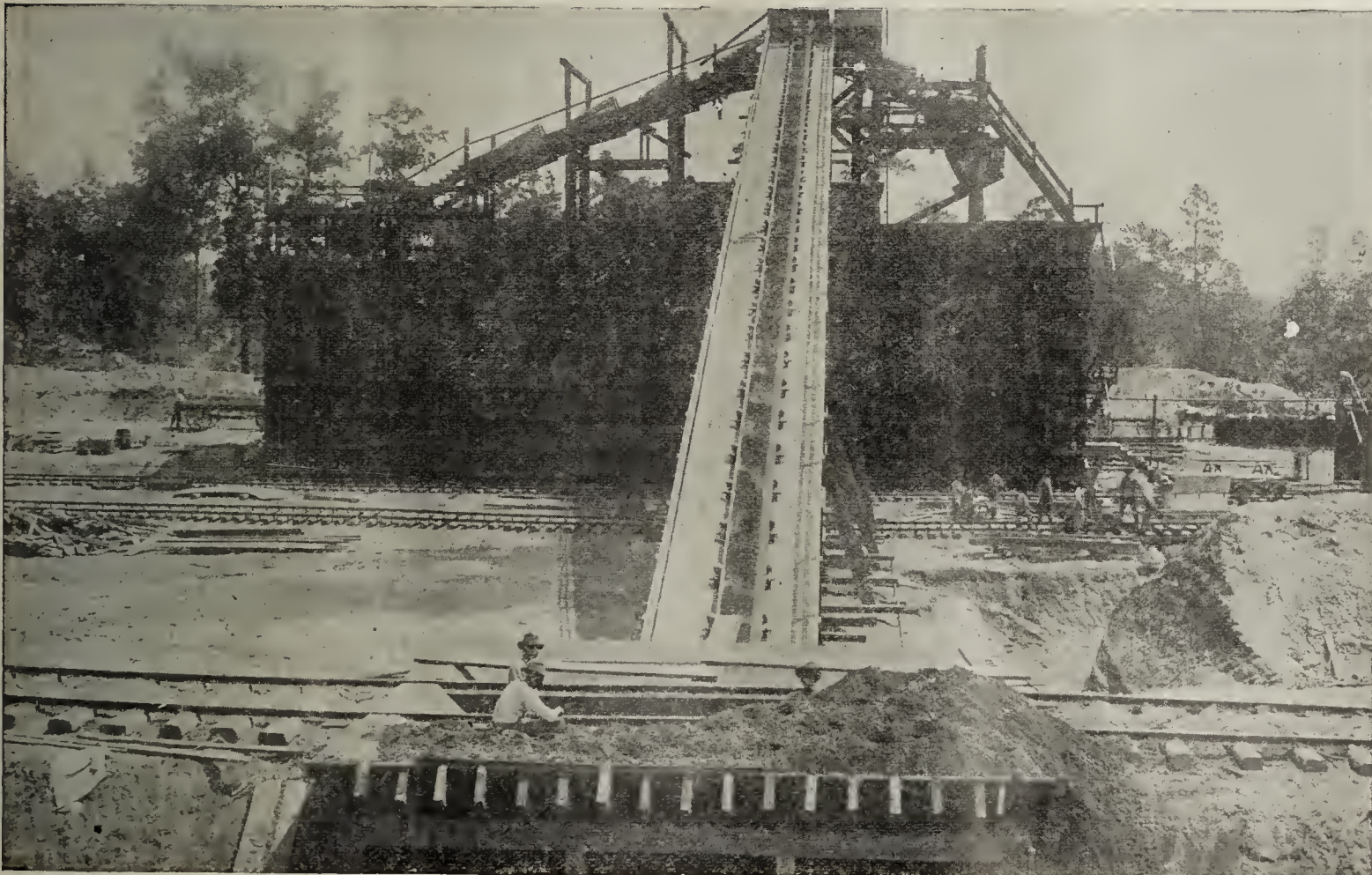
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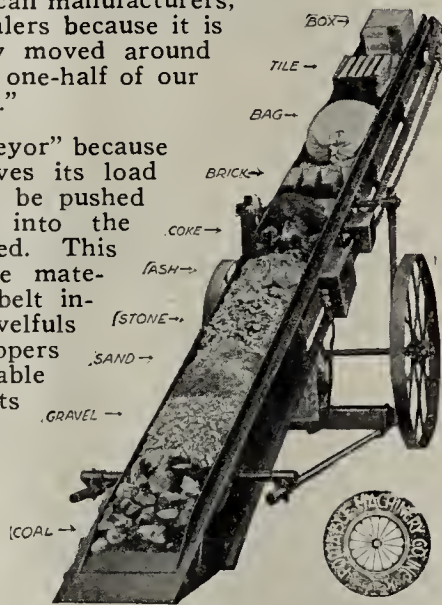
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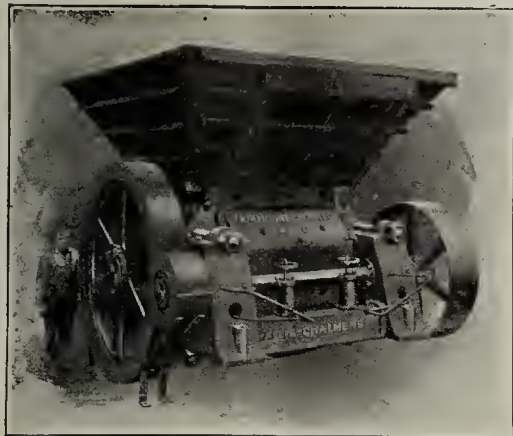
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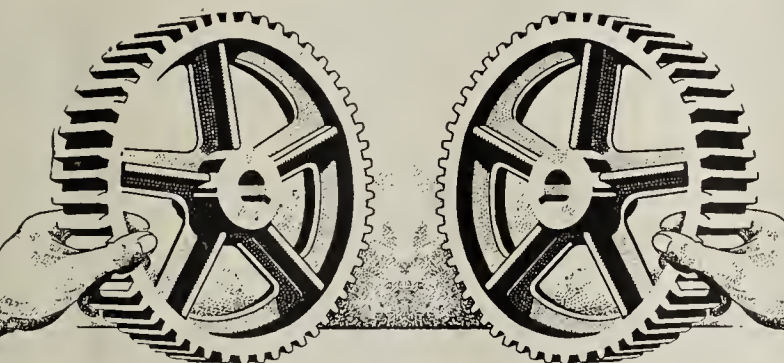
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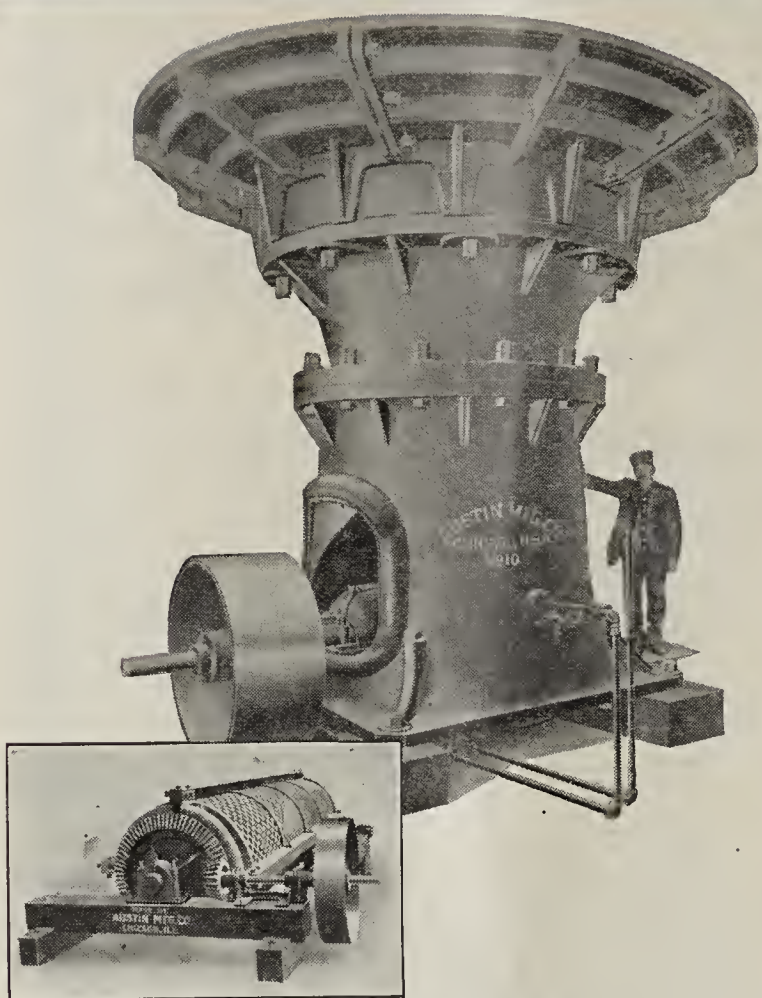
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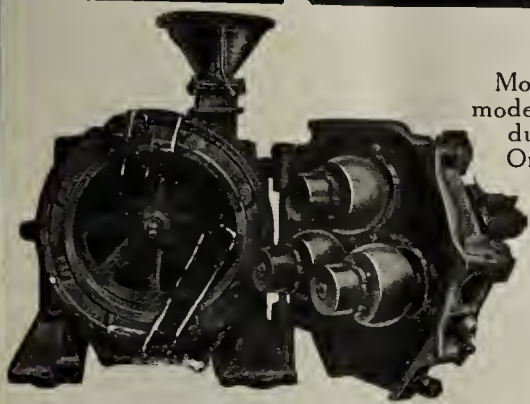
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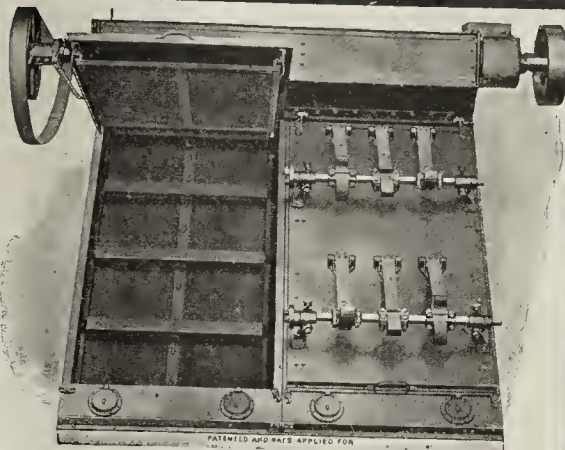
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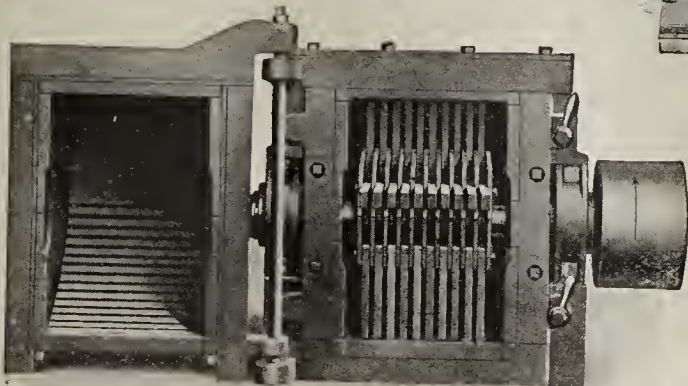


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IN THE WORLD

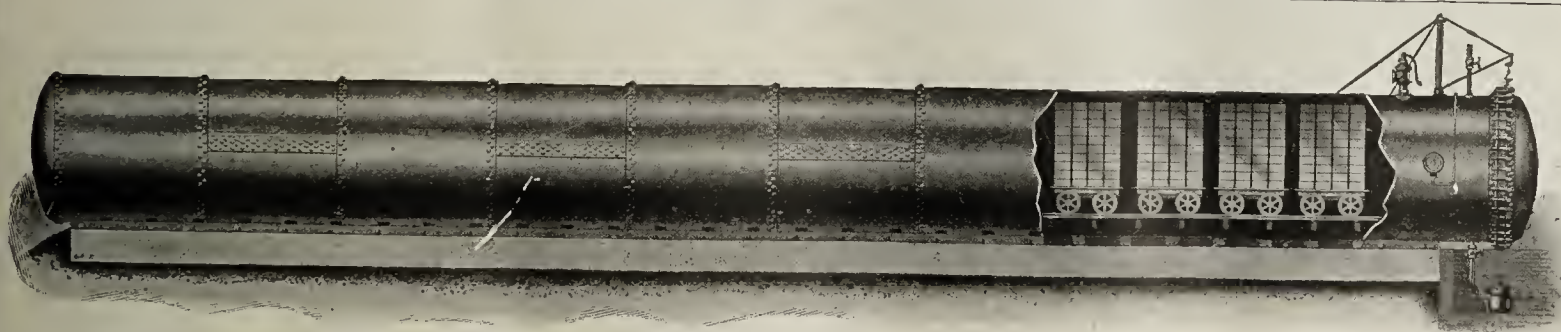
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Sand Lime Brick Machinery

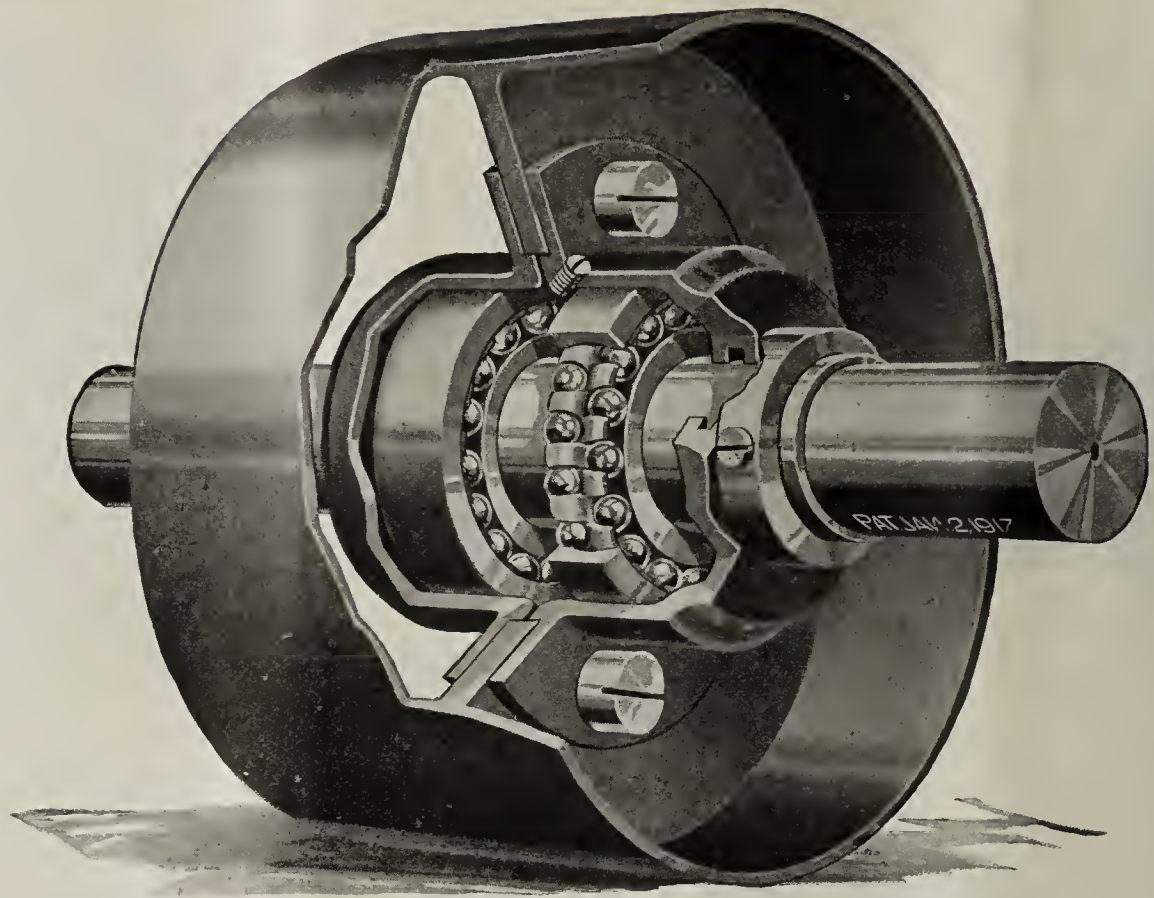
Our complete line of Sand Lime Brick Machinery makes it possible to secure just that machinery which is required to make your plant a success. We favor no particular type of machinery but are guided by the needs of the customer. Our wet and dry grinding mills have transformed a number of unsuccessful plants into dividend producers, while our Presses, Mixers, Hardening Cylinders and other equipment are of equal quality. We can exactly meet the demands of any manufacturer with a quality of machinery which will operate at a profit with a minimum amount of attention and expense.

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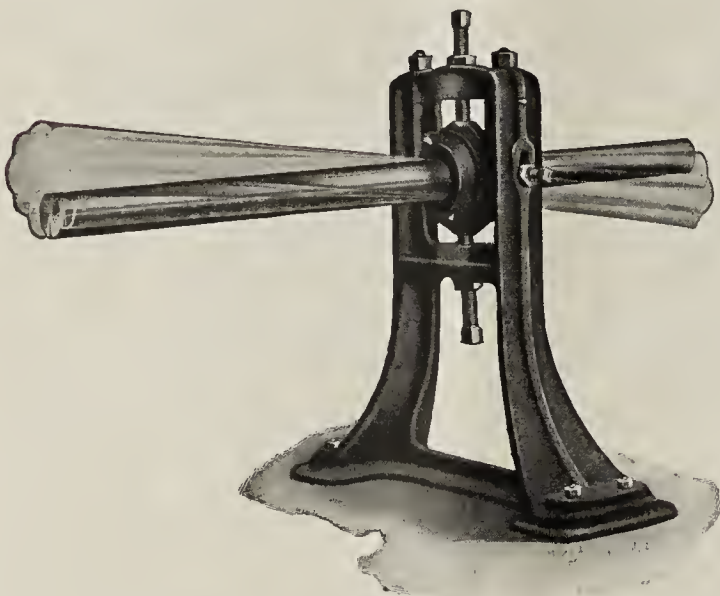


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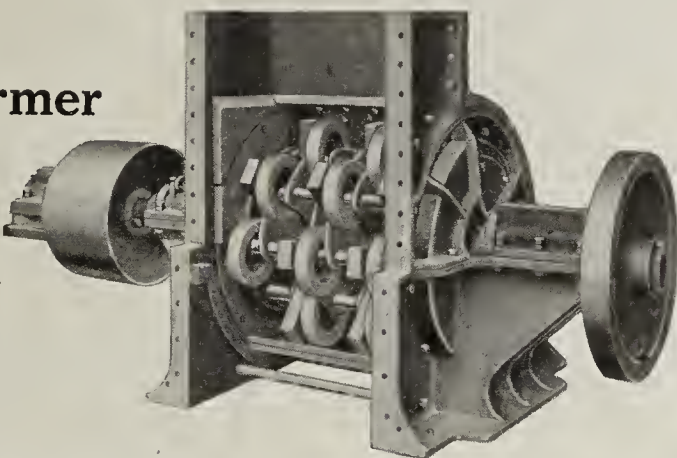
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Ring Pulverizers

are earning enormous profits for their users. The plant here shown paid five times its cost in profits in five months running. This is not an isolated instance. Many others have done equally well or better in producing

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The profits are large; the market far bigger than the supply. Install a guaranteed machine—An American Ring Pulverizer.



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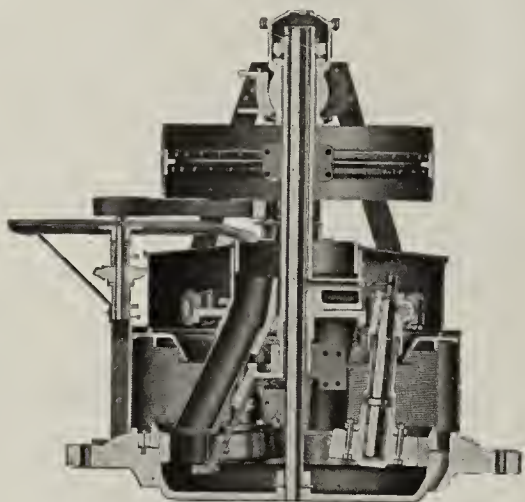
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AS A preliminary pulverizer of cement rock, limestone and clinker, has demanded attention of its merits. Most of the progressive cement manufacturers are either using or investigating this machine. It is surprising to know how many of these mills are in successful operation and more surprising to note its tremendous output, extreme fineness of product, low horse-power consumption and exceptionally low maintenance cost. Why not let us send one of our engineers, to show you how much more efficient this mill is than your present preliminary machines?



This mill has taken its place as the most economical preliminary machine ever used in the cement or agricultural limestone plant.

Let us give you complete data on its performance for the last five years—it's yours for the asking.

Twenty-two mills sold without advertising—a record unequaled in the cement industry.

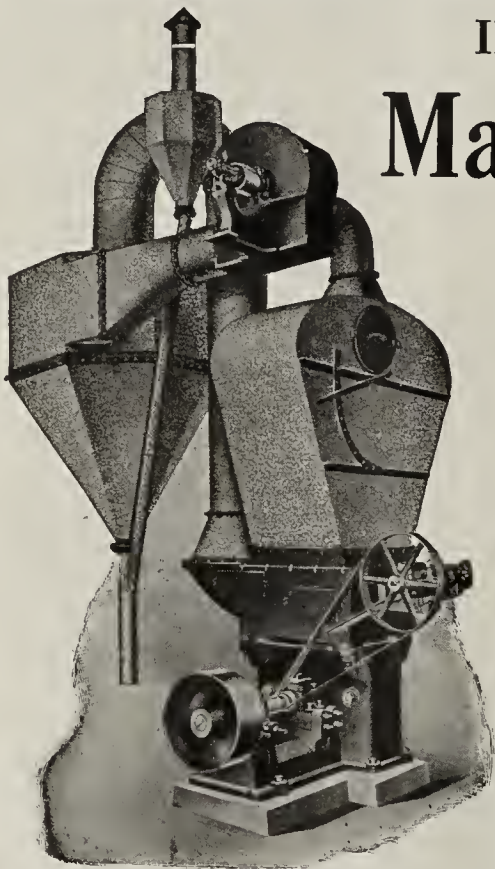
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**We Build Crushers from 5 Tons to 300 Tons
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Editorial

Portland Cement Association Increasing Promotion of Cement Products and Farm Structures

In recognition of the broadening opportunities for promotion in the field of cement products and farm uses of concrete, the Portland Cement Association has recently organized at its headquarters at Chicago, the Farm and Cement Products Bureau. The new department absorbs several former bureaus and the facilities thus made available are to be concentrated on a general campaign for cement products and the farm and small general uses of concrete throughout the country. A. J. R. Curtis, who has been in charge of the educational and farm promotion work of the association for the past few years, is manager of the new bureau.

In discussing the opportunities for promotion work in the field covered by the Farm and Cement Products Bureau, Mr. Curtis points out that there are at present many unusual advantages for the products manufacturer and the small contractor, and many good reasons why manufacturers of cement are fully justified in the present plan to devote proportionately more attention and make larger expenditures than heretofore in the development of these fields.

The "own your own home" movement, which has grown to national proportions and has been strongly sponsored by the Federal government, offers an unusual opportunity for products plants specializing in concrete building units. By correspondence with the U. S. Department of Labor, anyone can learn how to start and successfully carry on a local "own your own home" campaign with Government help. The value of encouraging home building cannot be overestimated from either a commercial or a patriotic standpoint. It is highly desirable in the interests of the common good that savings accumulated by workmen during the war should be invested in a home or something else of permanent benefit rather than spent thoughtlessly or hoarded. With the country practically 1,000,000 dwellings behind its requirements, the present and prospective market for concrete block, ornamental trim and roofing material cannot be questioned.

The farmer will no doubt be a very large purchaser of cement products during the coming months. His bushel of wheat which was exchangeable for 21 feet of concrete drain tile in 1914, pays for 45 feet of the same tile today. The concrete silo which cost 778 bushels of corn in 1916, cost only 510 bushels of corn in 1918. In general the financial condition of the farmer is so much better today than it was a year or two ago, that the wobbly wooden silo which appealed then because of lower first cost doesn't interest him now. His choice is some permanent type—monolithic, cement stave or block.

Large as it is at present, the field for the promotion and sale of cement products gives promise of great immediate expansion. The Farm and Cement Prod-

ucts Bureau of the Portland Cement Association, 111 West Washington Street, Chicago, is at the service of present and prospective products manufacturers and welcomes at all times the opportunity to co-operate in working out manufacturing and selling problems.

Government Bulletin Discusses Firing and Quitting

"Not knowing how to do a job has two results: First—low efficiency and, second, quittance or discharge—labor turnover. Each of these operates to increase the cost of production. Both worker and employer pay a penalty for this condition, just as each would profit by its correction."

The above is one of the interesting statements in a vest-pocket bulletin entitled "Labor Turnover and Industrial Training," which has been issued by the U. S. Training Service of the Department of Labor. The pamphlet contains many other pointed observations of value to manufacturers and labor men, as well as to all others interested in modern economic questions.

In discussing the present enormous turnover in industry the bulletin says:

"It may be convenient to ascribe this excessive and burdensome labor turnover entirely to restlessness, instability and perversity of the workers. * * * The truth is that labor turnover is not wholly or even largely the fault of the workers."

The publication then goes on to tell of an illuminating study of the causes of discharges and quittances in a large manufacturing plant. But 10 per cent of the separations, it was found, were due to slacking, while 90 per cent were attributable to shortcomings and defects of one kind and another in the management of the plant. The special point which the bulletin makes in this connection is that industrial training conducted in the plant results in the worker being better fitted for his job. Hence he earns better wages, produces more for his employer, has a greater sense of self respect, and remains at his task instead of periodically shifting from job to job.

The U. S. Training Service is devoting special attention to preparing courses in the proper methods of training in various industries so that interested manufacturers may be supplied with adequate material for operating training departments. In addition to the bulletin mentioned here the Training Service has issued several other pamphlets on training which will be mailed to anyone addressing the service, care of the Department of Labor, Washington, D. C.

American Concrete Institute Annual Meeting, June 27-28, 1919

In pre-war times the American Concrete Institute had its annual meeting in February because at that season there is less activity in the concrete field and a larger attendance is possible. Owing to the war, the February, 1918, session was postponed until June, when it was held at Atlantic City at the same time as

the annual meeting of the American Society for Testing Materials. This year the board of direction considered it inadvisable to attempt another February meeting and has called the meeting announced in the following program once more to be held at Atlantic City, where, through the courteous cooperation of the officers of the American Society for Testing Materials, meeting there at the same time, one evening's joint session is possible. The other meetings of the Institute have been arranged so as not to conflict with the meetings of the other society, and an open afternoon has been left on Friday so as to permit the members of the American Concrete Institute to attend the session of the American Society for Testing Materials at which will be discussed the subject of cement, a matter of greatest interest to members of this society.

Especial attention at the June meeting will once more be given to the subject of concrete ships. Last year the reports were largely on what was expected to be performed. This year the engineers who have been specializing in concrete ships will be able to render reports of what they have done. Although the closing of the war shut down a number of the forward movements in concrete ships, still the development has been probably the most important one in the concrete industry in the past decade and authoritative statements regarding its present status should be looked forward to by all interested in concrete.

Westinghouse Company Establishes Memorial Scholarships

As a proper war memorial to the more than 8,000 employes of the Westinghouse Electric & Manufacturing Company who have entered the service of the Government in the great war, this company has decided to establish a number of technical scholarships. The details of the plan by which this will be done have been given out by President E. M. Herr as follows:

"Four War Memorial Scholarships will be established each year under the following general conditions:

(a) Candidates will be limited to sons of employes of the Westinghouse Electric & Mfg. Company and its subsidiaries, who shall have been employes in good standing for a period of five years.

(b) Two of such annual scholarships may be open to the younger employes of the company or its subsidiaries who have been in their service for a period of at least two years and who do not exceed the age of twenty-three.

(c) The selection is to be determined by competitive examination to be conducted annually by the Company's Educational Department under the direction of the committee hereinafter provided. The examination is to take into account not only the applicant's academic training and preparedness, but due consideration will be given to personal qualifications, general character and aptitude.

(d) Scholarships will entitle the successful candidate to pursue a four years' course in any technical school or college that he may select with the approval of the committee. The scholar may pursue a course in any branch of engineering that he may select.

(e) Scholarships will be granted for one year only but will be continued for the full four years provided the scholar pursues a course in any branch of engineering that he may select.

(e) Scholarships will be granted for one year only but will be continued for the full four years provided the scholar maintains the academic and other stan-

dards required by the college or institution in which he elects to pursue his course of study.

(f) Each scholarship carries with it an annual payment of \$500.00 to be made in two installments and the number of new scholarships will be four each year.

(g) The company will establish a Memorial Scholarship Committee consisting of three vice-presidents of the company to whom shall be referred the names and records of the candidates and who will select therefrom the four successful persons, who, in its judgment, have most satisfactory met the tests applied. The said committee will also be charged with the duty of establishing the detailed rules and regulations and such other matters of administration as have to do with this particular matter.

It is the intention of the company to continue these memorial scholarships from year to year but the company reserves the right to recognize changing conditions and to modify the plan or discontinue it entirely, if, in its judgment, it seems wise and expedient to do so."

Make America a Better Place in Which to Live

We went into the war to aid in making the world a better place in which to live. Behind the victory of arms, if the United States is to appropriate her share of the fruits of victory, must be the determination to do those things which make for prosperity and for happier and more contented people.

Homes, the very foundation of the social structure; schools, the mold in which our citizenship is cast; roads, the arteries of commerce; churches, springs of spiritual inspiration! These we need in increasing numbers throughout the land if America is to be made a better place in which to live.

War interrupted our construction work in these lines. The country needs almost a million homes right NOW. It needs hundreds of schools. There are not enough good roads or churches.

To resume work in these lines immediately means convincing evidence of your faith in the country's future; it means stimulation for all lines of business; and, of profound importance right at this time, it means a demand for labor—employment for the returning soldier.

Physical Properties of Dense Concrete

The University of Texas has published an intensely instructive Bulletin No. 1815, "Physical Properties of Dense Concrete as Determined by the Relative Quantity of Cement," by Professors Giesecke and Finch.

The bulletin shows how the compressive, tensile, and transverse strengths and other physical properties of dense concrete vary with the percent of cement used in the preparation of the concrete; and thereby enables the designer and the builder of concrete structures to effect the greatest possible economy in the use of concrete by requiring the fine and coarse aggregate for the concrete to be mixed in such proportions as will secure a dense mixture, and adding only such a per cent of cement as is necessary to produce the strength or other physical properties desired in the concrete.

The bulletin is for free distribution on application to Publications Committee, University of Texas, Austin, Texas.



West Washington Street Concrete Bridge Over the White River, Indianapolis, Ind. Luten design

Reinforced Concrete Bridges and Their Architectural Treatment

By F. G. Engholm, C. E.

The influence of engineering structures upon the community life of people is of great national importance. The standards of beauty are enlarged with the growth of knowledge.

The creation of beautiful structures can only be attained by a full and true knowledge of the kind of materials used and by certain subtle distinctions born of integrity of purpose and refinement in handling them.

The use of masonry for bridges must now be regarded as a thing of the past, chiefly on account of the prohibitive cost. The longest single span in masonry in existence is 295 feet. The rise and dimensions of a masonry arch are necessarily large and are especially noticeable in spans of any appreciable magnitude. And further, the restrictions of site such as clearance and depth of construction, often limit and affect the general design, economy, etc., of the structure so as to render the use of masonry prohibitive in face of modern development.

The graceful lines of a reinforced concrete arch bridge with a shallow rise and comparatively small dimensions of the various members, give a touch of refinement which cannot be approached in any other material.

In steel structures the aesthetic treatment assumes a different character. To attempt to ornament any steel structures of large span would be entirely false, and foreign to the fundamental principle of their design. Its application, if done at all, could only be carried out consistently by a great increase in weight

and sacrifice in economy. In the case of the Forth and the Quebec bridges, for instance, no pretense is made to decorate these structures. They are too colossal in proportion, themselves, to require any such treatment. The designer of the Forth bridge stated that the design pretended nothing but to tell the truth as simply as possible and, inasmuch as it does, it is beautiful.

These massive structures are rare occurrences in the history of a country and in dealing with "everyday" structures, reinforced concrete, in its dimensions and applications, gives proportions of beauty all its own.

The steadily increasing use of reinforced concrete as a structural material in the last few years thus opens up a line of thought in its architectural treatment, worthy of the best effort of the artistic as well as the practical mind. Designers, apparently, have not yet realized the structural possibilities of reinforced concrete or else they lack that special knowledge of the material to foster its more prolific use in their works. In a few cases, however, designers, mostly of the younger and more progressive element, are investigating its possibilities.

To confine myself to bridges and their particular architectural treatment in the space of a short article, it is necessary to condense and be brief. At the outset, it is well to realize that reinforced concrete is a material that one must have a special, practical and studied knowledge of, to create development along the right lines. No amount of collaboration of architect, artists and engineer, will create a thing of beauty if one and all do not appreciate and thoroughly understand the application of this material.

I am not condemning this collaboration of architects, artists and engineers, so long as the combination working together know the material they are assembling. For instance, take the case of the Bassano dam. Here the combination was not successful. This is a magnificent piece of reinforced concrete engineering, which is surmounted with gate houses designed by the collaborating architect in a half-timber affectation which seems altogether out of keeping with the ponderous structure beneath. The very permanence of reinforced concrete demands that its accessories be permanent also.

The art of building, generally, at the present time, seems to be at a serious crisis; look where we may nothing is seen but a hodge-podge of styles, or rather periods—Oriental freaks and French wedding cakes rub shoulders with English affectations, and only here and there does a structure seem to live and breathe the 20th Century. Reinforced concrete, when universally accepted as the great structural material it is, must if the designers using it be true to the material and themselves, be the foundation of a great transformation in the mode of building—for the better, we believe—because the elements of concrete construction are so simple. As I have said before, with the elimination of the complexity of construction now in use, we may be confident of the evolution that will take place in the ages to come and be proud to think we were the pioneers of the great thing that will live in the generations hereafter.

We must not, as a few would have us believe, sever ourselves completely from tradition, nor is it right, in my opinion, to take as the heritage of the past merely the trimmings, as seems to be the case with most constructural works, with their burden of cornices, columns, useless porticos and other impedimenta so dear to the heart of the average architect today. Whereas in the preparation of a design in reinforced concrete, the fitness, proportion, and adaptability are the first issues that assail the designer, and the majority of them fail to create anything worth while for the following reasons:

1. Their inability to understand the scientific and working spirit of concrete.
2. The lack of that knowledge to furtherance of thought in terms of concrete, and
3. The impossibility of abandoning the knowledge they have already acquired in building with other materials.

With the perfect knowledge of these first three points a thing of beauty will result, and no amount of elaboration will remedy faults in these first three points. It is absolutely essential in reinforced concrete to keep clear of the changing whims of artistic fashion, and to evade the traditional architectural features in wood, stone and iron. Decoration on reinforced concrete bridges should be used sparingly, and only when the use of such decoration will bring out the beauties of the fundamental principles of design.

Following along this same line of thought, one thinks of some of the great bridges already constructed under the combined thought and work of engineer and architect, and if we accept our previous views we must realize that these structures, though beautiful in themselves, as specimens of studied poetry, fall short of the great idea. For the most part, they embody forms and details which we readily associate with other materials. Cannot the designer think in other terms than the five orders? To me there is only one order—"Fitness."

As a simile might I for a moment be excused a diversion: Take the automobile; the first of these modern means of locomotion were naturally very similar to the carriage, and in some very early drawings, indicating the ideas prevailing at that time, one might find the two personages, coachman and footman of the old staid carriage, mounted up high, in front of the vehicle, and even in some cases, the means of steering was illustrated as a sort of rein attachment in the hands of the coachman. In comparison, look at our modern auto, the acme of engineering perfection, bearing no resemblance to any other vehicle; this upon careful analysis, is found to be purely a matter of elimination and simplification.

Thinking of reinforced concrete bridges in a more intimate way than we have above, several phases of character present themselves, and when we realize the distinctiveness of concrete from all other materials, we must appreciate the opportunity that knocks at our door for a distinct expression. Among these characteristics is the solid purity of line, the mass, the bulk, whatever one cares to apply, should undoubtedly dictate the first steps in a reinforced concrete creation; next, probably, the thought comes of the way in which this material is assembled, i. e., poured. This seems to dictate flowing lines, continuity, and elimination of all the small distractions. A structure designed to comply with these and the other three points previously raised and truthfully dictating its function cannot but lift a new standard to the world to proclaim the progression of the 20th century.

That severe critic of the Building Art, Mr. Ruskin, whether we accept all his statements or not, was right when he said "Nothing is beautiful that first is not true."

I have dwelt above on the error of trying to produce a living structure by using forms associated with other materials, and must indulge the reader's forbearance in repeating this remark, as its importance cannot be too strongly emphasized. There is still a more intimate imitation that must strenuously be avoided, and that is the actual reproduction in concrete of some other material, such as rock-faced ashlar, rusticated stonework; these and many others are a degradation to reinforced concrete and an insult to the material it imitates. To the expert designer the treatment of the finished concrete should open up many new interesting effects. Many of those already in popular use are: the careful selection of a surface aggregate which is then either polished, producing that beautiful effect we know as terrazzo, or by sand blasting the surface marks from the interstices and leaving the aggregate free, producing an effect similar to rough cast. Then again, the aggregate may be varied by the use of either lime stone, granite or marble chips, which might all be combined or used separately at different points of the whole structure without destroying its continuity.

The one great thought that raises itself in connection with the decoration of a reinforced concrete structure is, that it must of necessity be of the structure. This is the argument of the Gothic revivalists in favor of their style, of which there is scarcely an old world example existing that is not beautiful. The idea of precasting tons of useless features heretofore associated with stone, at present expressed in so many of the concrete structures already built, is in no way significant of progression, and as soon as we forget the cornice as it is at present detailed, and the column of ancient Greco-Roman times, and give our more strenuous attention to such means of decoration as



Inland Park Concrete Bridge, Winfield, Kans. Luten design

burnt clay, tile insertion, etc., the more readily will the ground be clear of weeds to begin ploughing through this vortex of existing affectations. At this point, I feel it would be as well to say a few words about the decorative value of iron work. Because a bridge is of reinforced concrete, it would be ridiculous to assign the material to some duty for which it was not functionally the best suited; wrought iron used carefully, and lovingly designed by an appreciative craftsman, will add greatly as an accessory to the general effect. Gates, lamps, and sometimes standards, trolley poles, coats of arms, metal weatherings, inscriptions, if properly designed, lend that touch of contrast so necessary to any work of art. Contrast and harmony are synonymous in the hands of the gifted.

Applying reinforced concrete to bridges, relieves us of one of the greatest obstacles to beautiful structures: the elimination of complexity in constructing a structure whose function is simple; the functional idea should then be the key note of all reinforced concrete bridges. The bigness and, at the same time, the smallness of the function, is such as to simply demand the elimination of trivial details, especially seeing that we cannot comprehend the beauty of a bridge except at a comparatively great distance. The human eye would fail absolutely to appreciate for instance, small heads at intervals on a string course, so it would seem as well to confine any of the smaller elaborations to the roadway itself, such as the decoration of lamp standards, seats, coats of arms, trees, shrubs, etc., etc., where the human eye can readily grasp their significance and enjoy their beauty.

It is readily seen from the foregoing remark that to make a successful project it is not necessary to spend an enormous amount of money. In point of fact, the percentage on the cost of the whole structure can scarcely be appreciated, it is so small. The ease with

which these decorations can be effected is also a consideration; the majority of them can be left out without destroying the beauty of a design, and placed at some more appropriate time. Of course, there are still those first three points which should stand, and in themselves create a beautiful bridge, with the other adornments merely as furniture to the home.

In conclusion, I want to touch briefly on the subject which is far from the least important and which as yet I have refrained from talking about until this stage. I refer to color. There seems to be in reinforced concrete a chance that we shall again take up a true heritage, handed down to posterity by the ancients, which, in the last century, has gradually dwindled and waned until our surroundings are as drab as our lives. If we study classical architecture it will be found that our ancestors were partial to building in colors. The excavation of classical buildings at Var Catena, Brioni Grande, and Barbariga, has brought to light many proofs of this. We can understand, to a certain degree, in countries with temperatures such as in England, that color is not so important, but in a continent such as ours, with its brilliant sun and more brilliant snows, color is the greatest note we can strive to incorporate, and so in our bridges and great engineering works, which in so large a number of cases, are built in such close juxtaposition to nature, do not forget that God intended color to be one of the most beautiful notes that human can strike, just as He played it in the supremest creation of all.

Leigh Hunt Co., Engineers

Leigh Hunt announces the formation of a new organization, the Leigh Hunt Company (successor to the Hunt Engineering Co.), Kansas City, Mo. The company has opened offices in the Reliance Bldg. and will engage in general engineering and contracting.

An Electrically-Operated Quarry and Plant for Production of Broken Stone at Gary, Ill.

The production of broken stone has developed into an industry of very large proportions in Chicago and the extensive territory of which that city is the material supply market, owing to the constantly increasing demand for broken stone in engineering, industrial and construction work. This growing demand is due largely to the great and rapid development in the use of concrete for a variety of purposes, partly to the great activity in all kinds of construction work in which stone is used, and partly also to the development of iron and steel manufacture in the district named, requiring large quantities of limestone for use as flux in the blast furnaces. There are extensive stone formations near Chicago, and in the district southwest of and adjacent to the city (and within the limits of Cook County) there is a limestone formation of considerable area and depth, which has been worked for

conveyors; (3) for the small number of men employed and the small labor cost in relation to the large capacity of the plant. This last feature is due to the general use of electric power and mechanical operation, and reduces the labor problem to a very minor consideration.

The plant is not only of interest as a whole, but presents many important and special features in all the stages of the work, from the drilling of the blast holes to the loading of the finished product into cars for shipment.

The quarry and stone plant at Gary, Ill., are about 18 miles from Chicago, near the Chicago Drainage Canal and on the line of the Chicago & Illinois Western Ry. This road gives direct access to Chicago and connection (by the various belt lines) with all the railways entering that city. The company has 300



Dolese & Shepard Company Crusher Plant at Gary, Ill.

many years as a source of supply of stone for various purposes.

The Dolese & Shepard Co., of Chicago, owns large property in this district (at Gary, Ill.), and has in operation one of the largest broken stone plants ever built, with quarry equipment and stone crushing and screening machinery which are not only of exceptional capacity but are of exceptional interest from an engineering standpoint. The plant is specially notable in three ways: (1) for the extent and character of its

acres of land, of which 130 acres are available for stone quarrying to a depth of 250 ft., as determined by core drills.

Operation of the Quarry

The general formation of the limestone is shown in one of the illustrations. Blasting is done from holes, well back of the face, so that the rock is loosened as shown, but not thrown down. The quarry is opened up in lifts of about 40 feet, the blast holes being drilled with 7 (seven) "Cyclone" drills, electrically operated. The drills make 5-inch holes.

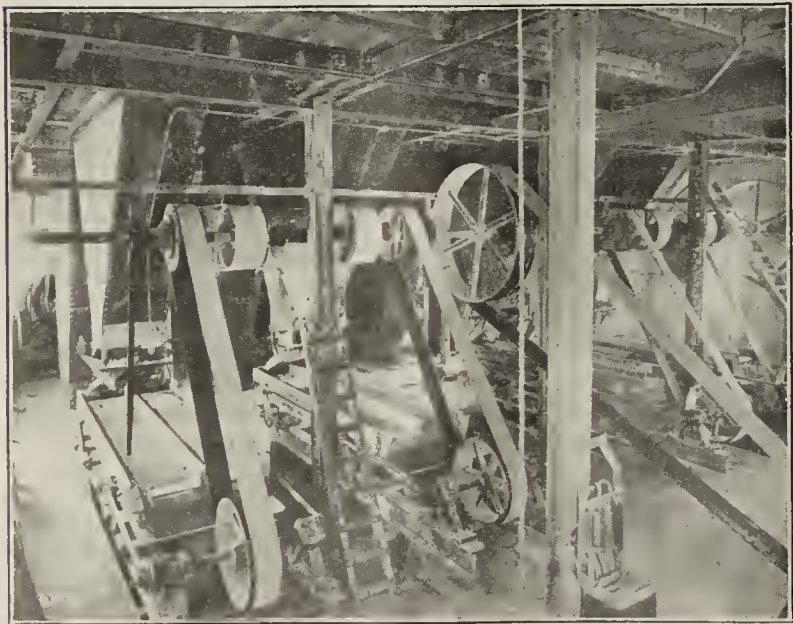
Four steam shovels are now regularly employed in getting out the rock. These range from 95 tons to 110 tons and are equipped with manganese steel dipper.

Serving these shovels is an electric railway system of unusual interest, operating upon the third-rail principle. Standard-gauge, motor-driven cars of special design are constructed with frames and trucks of steel. The body of each car, while of wood, is lined with steel plates, being 10 by 9 by 3 feet. It dumps to the side through a tilting door. The cars weigh from 15 to 18 tons each and have a capacity of 15 tons.

Two 35-horsepower, 220-volt motors are provided to each car. The solenoid brakes and control system take current from the power rail, but at a temporarily reduced voltage.

Loaded cars coming from the quarry are driven up into the second story of the initial crusher building, dump to inclines on each side of the crusher, and continue through the building and back to the quarry.

Dumping of the cars is accomplished by electrically operated apparatus controlled by an operator. This consists of an overhead shaft parallel with the tracks and fitted with two cams. These cams, by a chain and hook, tilt the car body to dumping position.



View of the Eight Shaking Screens

rock crushing and handling machinery; (2) for its electrical operation throughout, including that of loading shovels and haulage system in the quarry, and of the entire equipment of crushers, rolls, screens, and



Loading Crushed Stone in Dolese & Shepards Quarry

Entire movement of the cars, out through the quarry, to the crusher house and back to the working face, in one continuous circuit of operation, is controlled by one man (with the exception of the dumping operation just described). This is accomplished by the Woodford system of remote control.

The outstanding features of the system as applied in this case may be mentioned briefly. There is a double track loop with crossovers at intervals; one being the main track and the other the loading track. The cars are all controlled from a tower near the crusher house and in sight of most of the circuit. Each car may be operated independently of all the others—started in either direction or stopped with the brake at any point in the system of tracks.

Switches at the crossovers are electro-pneumatically operated and controlled from the tower, and in conjunction with a system of electrical signals, as perfect in detail as those of a railroad interlocking system. Very much of the system, is, in fact, automatic in operation. The operator is called upon to start the car out of the loading tracks onto the main line, but the system is arranged so that the car automatically selects its proper track at the crusher.

In descending the incline on its way back to the quarry, the car is moved by gravity only, with a dynamic brake feature which holds it to a predetermined speed. The control of the cars, as far as the operator is concerned, resolves itself into three operations: Starting them from the shovels; bringing them forward to the crusher; starting them on the return trip. Everything is controlled by push buttons, with automatic safety devices at every point of the journey.

At full capacity 6000 cubic yards are moved per 10-hour day, using 30 cars. This is figured on the basis that the material is moved over approximately 6000 feet of tracks.

The contents of each car is weighed on an automatic track scale, while the car is in motion, and this by a non-interfering signaling device, which indicates and records the number of the shovel loading it as well as the weight of the load—all on a recording tape.

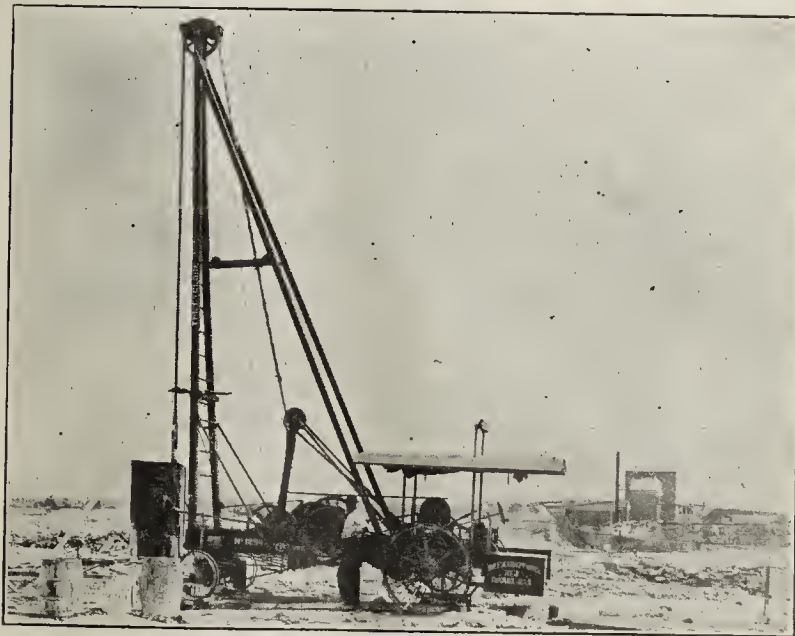
Ingenuity is shown at every turn of this system. For instance, the 220-volt motor current and the brake

current (30 to 100 volts) are impressed at will upon the 25-pound third-rail. This conductor rail is divided into sections separated by insulated joints, and each section with independent connection with the control apparatus in the tower. Thus the car on any section can be controlled independently of that on any other section, or, when more than one car is on a section they are controlled in the same way, as a unit.

Crushing and Screening Equipment

Reference to the general view will give a clear idea of the layout of the plant, the various buildings being numbered and named.

In the first crusher house is a large gyratory crusher with a 20-foot hopper. This is driven by a 250-horsepower motor by a rope transmission system. It has a rated output of 8000 tons of stone per 10-hour day, reduced to 6-inch size. This discharges to either or both of two parallel pan conveyors 114 feet long, and on a 45-degree decline to the second crusher



The "Cyclone" Drills in Operation

house. Here it is reduced by two No. 9 Gates gyratories to 4-inch size and less. They in turn deliver the product of two revolving screens, passing 2½-inch,

or less, stone to belt conveyors, and the oversize to two elevating pan conveyors. This oversize is classed as "flux size" and is sent to a special storage building to be sold for blast furnace flux. Any part not sold for this purpose is sent back to the No. 6 crushers, of which there are eight.

Small size stone from the No. 9 crusher screens is sent to the No. 6 crushers by two 24-inch horizontal belt conveyors, which deliver to two 30-inch belts operating at an angle of 23 degrees. The total length of this incline is about 330 feet, and that of the belt



Incline Belt Conveyor to Screen House and Storage Bins

665 feet. These belts deliver to the main screen house.

Here are located 24 screens in all—16 revolving and 8 shaking, the latter for the smallest sizes. Rejections from these screens may or may not be returned by horizontal conveyors to a recrushing plant, according to the kind of product desired. This plant consists of two sets of rolls.

Crushers, screens, rolls, etc., are all operated by induction motors, most of the larger machines being individually driven.

Cement Companies Combine for Foreign Trade

Ten Manufacturers, Taking Advantage of Webb Act, Organize Cement Export Company

Portland cement manufacturers have just formed a company for foreign sales only, under the provisions of the Webb act. Ten companies have already joined the organization, which is known as the Cement Export Co., and has offices in New York City, and invitations to participate in the new organization have been extended to all Eastern cement manufacturers.

The following were elected directors of the Company: Emil Loeb, Coplay Cement Manufacturing Co.; J. Brobston, Dexter Portland Cement Co.; J. A. Horner, Nazareth Cement Co.; L. C. Morton, Phoenix Cement Co.; George F. Bayle, Glens Falls Portland Cement Co.; J. W. Fuller, Allentown Portland Cement Co.; Frank H. Smith, Lawrence Cement Co.; Charles F. Conn, Giant Portland Cement Co.; Morris Kind, Hercules Cement Corporation, and F. W. Kelley, Helderberg Cement Company.

It is announced that arrangements are under negotiation with the Bureau of Standards to test all cement delivered by the export company and to certify that the cement fulfills all the requirements of the standard specifications of the American Society for Testing Materials.

As portland cement for domestic shipments is almost entirely delivered in paper or cotton sacks, and as most export shipments are called for in wooden barrels, the matter of cooperage is of great importance. Tentative plans have been outlined for the erection of a barrel-manufacturing plant at tidewater, with a large storage warehouse equipped with barrel-packing machinery in connection therewith. By having a large stock of cement in storage at tidewater at all times, the company, it is believed, will be able to take better advantage of the present somewhat limited shipping facilities to South American countries. While the Cement Export Co. expects that its activities will largely be confined to Latin-American countries, it will be in a position to supply cement to European countries if conditions make this desirable.

Limestone for Agricultural Use in the South

The place of lime in the agricultural program of the south is being discussed at a conference of southern agricultural experts held at the Hotel Atkin, Knoxville, Tenn.

Dr. H. A. Morgan is presiding. Prof. W. H. McIntire was appointed secretary.

The purpose of the meeting is to have technical experts, extension men and men who handle the limestone industry to come together in a unanimity of opinion and conformity of recommendation regarding the extension of the use of limestone, and the scientific application of the principles that underlie the use of it among those who are beginning to realize the revolutionizing value of it in the crop production of the southeast.

For the accomplishment of this result the co-operation of all limestone interests was recommended in getting out lime stone in quantity production. A limestone propaganda will be extended over the country where there is suffering from lack of limestone. This will be done by an increase in the extension of literature on the subject of the value of the mineral in the soil. Once farmers can be prevailed upon to try the experiment, it is estimated the growth in the use of limestone will grow naturally and rapidly, because, by experience, it has been demonstrated what a paying investment the application of the composition is.

Urge Limestone Storage Houses

It was recommended that great limestone storage houses be created at various points of vantage to farmers after they had become schooled in the use of it.

Interest in this afternoon's session centered around the address of Prof. E. O. Fippin, an expert from the school of agriculture of Cornell university. Prof. Fippin discussed the theory of the use of limestone in relation to the soil and the great increase in crop production as a result of it. Definite means of spreading limestone propaganda were advanced.

There will be a session of the conference at the Hotel Atkin tonight when the technical phases of the question will be discussed.

This afternoon the members of the conference visited the lysimeter plants at the University of Tennessee experiment farm.

Tonight there will be a session of the conference at the hotel, and tomorrow the members will pay a visit to Mascot where the limestone question will be further investigated.

Important facts that developed during the sessions are that Kentucky, North Carolina and Virginia are giving most attention to the experimentation with limestone, and are getting splendid results in crop production where it is being tried.

Investigation

was stated are using the southeast. Tennessee question, it was finding the convenience for the farmers manifested. The and Livestock" that are the key prosperity.

I. L. Grabes, Mis, Furman Prof. E. O. gham, At- Grimes, Vagner, W. R. Ken- ia; t,

High Prices

The average factory price per barrel for Portland cement in bulk in the different states in 1918 ranged from \$1.511 in Pennsylvania to \$1.894 in Washington; in 1917 it ranged from \$1.22 in the Lehigh district to \$1.69 in Washington. The average factory price per barrel for the whole country was \$1.596 in 1918, compared with \$1.354 in 1917, an increase of 24.2 cents, or 17.9 per cent. The prices in these two war years are the highest that have been realized for Portland cement since 1898 and 1899, when they were respectively \$1.62 and \$1.43 a barrel. The lowest average price, \$0.813, was recorded in 1909 and 1912.

The combined production of natural and puzzolan cements in 1918 was 432,966 barrels, valued at \$401,341, compared with 639,456 barrels, valued at \$435,370, in 1917, a decrease in quantity of 32.3 per cent and in value of 7.8 per cent.

In its canvass for the cement statistics above summarized the United States Geological Survey had the co-operation of the geological surveys of Alabama, Georgia, Illinois, Iowa, Maryland, Michigan, Minnesota, Missouri, New Jersey, New York, Oregon, Pennsylvania, Virginia and Washington.

Exports and Imports

The exports of hydraulic cement from the United States in 1918 were 2,252,446 barrels, valued at \$5,912,166, or \$2.62 per barrel, compared with 2,586,215 barrels, valued at \$5,328,536, or \$2.06 per barrel, in 1917. This represents a decrease in quantity of 12.9 per cent and an increase in value of 11 per cent. The imports for consumption in 1918 were 305 barrels, valued at \$200, or \$3.93 per barrel, compared with 2,323 barrels, valued at \$6,076, or \$2.62 per barrel, in 1917, representing a decrease in quantity of 86.9 per cent and in value of 80.3 per cent. The statistics of exports and imports were compiled from records of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

subjoined tables were compiled from reports from all mills in the United States.

Holes—General Utility of Tamping Bags

men generally realize the importance of tamping and of using proper tamping material. Tamping materials are not always available, so they use whatever may be near at hand with the result that more explosives are often used than necessary, increasing costs, or bringing down less work than could reasonably be expected from the quantity of explosives used.

Blasters are beginning to appreciate tamping bags of heavy paper and used in many places as a substitute for sand, clay, or loam to be used for tamping. They can be filled and taken into the hole for the job at the beginning of the day's work. They are thus sure of having a tamping material available for them at maximum breakage at least cost. They save time when loading bore holes.

Tamping bags are very useful when the blaster deals with large charges of blasting powder in cartons. They usually do when loading uppers or lowers. They are much more convenient than the funnels or cones for which pieces of paper are generally used.

They cost but a fraction of a cent each and their use always saves many times their cost by preventing loss in explosives or greater breakage of rock.

Handling Materials on a Michigan Road Job

Gravel for Concrete Dredged from Lake, Transported,
Measured and Mixed with a Minimum of Labor—
Fourteen Men Lay 800 Square Yards a
Day from Bins to Finished Base

About three and a half miles of what is known as the Shore road near Mt. Clemmens, 18 miles from Detroit, Mich., is being built with an 18-foot roadway of 2-inch asphalt on a 5-inch concrete base. The interesting feature of this contract is the complete mechanical system for handling material that is employed by the contractor, Thomas E. Currie of Detroit.

The concrete base is mixed one part cement to six parts gravel, the gravel being dredged from Lake St. Clair. The point at which the gravel is dredged is about two and a quarter miles from one end of the job and one and a quarter miles from the other end, and about one-quarter of a mile from the road that is being improved. The general layout consists of gravel bins, a track connecting these with the road under construction and a line of track along the side

mixer, three bags. The cement is t upon the subgr waste of materi hauling over th charge end of spreading and of ten men e loading bins, train and th The rate of feet per da of finish work p forward mov

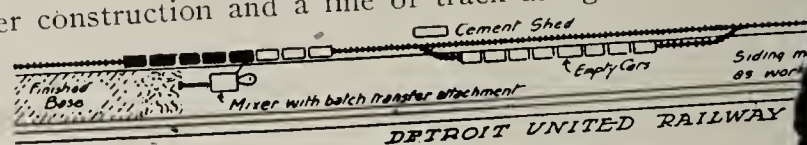


FIG. 1—SKETCH SHOWING GENERAL LAYOUT OF

of this road from one end of it to the other, two sidings being provided along the road, one of which is moved forward at intervals as the work progresses. The general layout is shown on the accompanying sketch.

Dredged gravel is loaded upon a scow on which it is taken to the shore of the lake, where the gravel is pulled off onto a gravel pile by means of a drag line. From the gravel pile the gravel is loaded into the bins by means of a steam shovel. These bins are constructed with bottom discharge and the track passes directly under them, so that the cars can be br directly under the bins, two cars being loaded at a time. The bottom of the bin is given a clearance of seven inches from the top of the car so that if the door should be left open by a careless workman the gravel would not overflow the sides of the car. This prevents waste of material at the loading point.

The gravel is carried in eight-car trains, each carrying two boxes. Each of these boxes carries gravel for one batch, or twenty cubic feet. A team can load an eight-car train of sixteen batches in six to eight minutes. Four cars are loaded at a time by a team of horses from the bins up a slight incline to the first siding along the road, and the team then turns for the other four cars and hauls them to the same point. From here they are moved to the second siding by a line locomotive which brings back a string of empty cars onto the other track of the siding and hauls the loaded cars to the mixer. Arriving at the mixer, the gravel is unloaded by means of a Lakewood batch transfer attachment, which lifts them from the cars at one time, and dumps them into the loading hopper of the mixer. This attachment carries a bail which is balanced that it will stay open and the train to move under it. The bail is connected with the box and the latter is swung open by three men and dumped into the hopper.

The locomotive also brings cars loaded with cement from the cement shed, each car hauling three bags. These bags are dropped along the side of the mixer. Two men handle the

This method of handling the material permits the use of a large-capacity plant on a narrow road, where there is only room for one narrow-gage track; it prevents loss of material and keeps the materials clean; it proportions the mix automatically by the uniform amount of aggregate transported by each car, and the work is not delayed by muddy subgrades which would be caused by rainy weather.

Concrete Bridge Built to Meet Changed Traffic in Warren County, Pa.

By A. C. Mook

President, Board of County Commissioners, Warren, Pennsylvania

Modern traffic on the highways of Warren County, Pa., reached a point early in 1916 when it became necessary to reconstruct a bridge over the Allegheny River in the city of Warren. The contract was awarded in June, 1916, to Charles Fath & Co., which firm completed a part of the structure, and in October of the same year the National Concrete Co., of Indianapolis, was engaged to complete the contract. The finished structure was accepted by the Warren County commissioners in August, 1918.

The old bridge was of steel-cable, suspension type, with plank floor, erected in 1871, and until recent years answered its purpose. The development of modern

D. Hawes, of the National Concrete Co., Indianapolis, acted as superintendent of construction.

Delivery of Sand and Building Supplies by Motor Trucks

The Rodgers Sand Co., Pittsburgh, Pa., was one of the first sand and builders' supplies companies in Pittsburgh to make use of motor trucks. At the present time the company is using six 5-ton and one 2-ton motor trucks.

The company's main yard is located on the Allegheny River. Most of the sand comes down the river in barges, which are tied up along the river edge.

An A-frame derrick is erected on a cribbing close to the water's edge and unloads the sand by means of a clamshell bucket into a double overhead hopper. The hopper nearest the river straddles a railroad track, on which some of the sand is sometimes received. There is also a second railroad spur between the hopper and the river's edge.

The location of the derrick is such that its boom can be swung to unload from either the river barges or from the gondola cars. The trucks are loaded directly from the overhead hoppers, which have inclined bottoms so that the material will run out by gravity.

Loading Time for Trucks.—The hoppers are furnished with coils of pipes into which live steam is fed during the winter months to prevent the moisture in the sand from freezing and clogging the hopper open-



Concrete Bridge in Warren, Pa.

traffic, however, with its attendant high-powered motor trucks, made further use of the old bridge dangerous. This fact, together with the constantly increasing maintenance charges, made a new bridge a necessity.

In adopting concrete the commissioners were influenced by the fact that future traffic must be anticipated and also by the fact that suitable material was available near at hand. The absence of maintenance charges on concrete was also considered, together with the artistic value of concrete in a structure of this size located in the heart of the city.

The completed bridge fulfills all the requirements that were taken into consideration by the commissioners. The fourth reason for selecting concrete, its artistic value, is proving to be one of the most satisfying results to the public, and the bridge is considered one of the attractive sights of the city and an asset from an architectural standpoint.

The completed bridge is 501 feet from face to face of the abutments. The four spans, beginning on the north end, are 128, 122, 116 and 108 feet, respectively.

The bridge, together with the approaches, is paved with concrete, 30 feet wide. Concrete walks on each side are provided for pedestrians. Along each rail is a row of artistic concrete lighting standards.

D. B. Lutten, Indianapolis, Ind., designed the bridge. George Dunham, Harrisburg, Pa., was engineer. R.

ing. A load of 5 tons of sand can be deposited into the truck body in from 4 to 5 minutes' time. This quick loading enables the trucks to spend a large percentage of their time actually in motion delivering their loads. This time is further increased by the use of dumping bodies with hydraulic hoists on all of the trucks.

The Rodgers company has also found its trucks very well suited to steam shovel excavation work, since the



Concrete Pavement on Concrete Bridge in Warren, Pa.

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Your INDUSTRY specially STUDIED

That Goodrich rubber products are specially adapted for your industry, is seen in the special catalog "Goodrich Rubber Goods for the Stone Industry," a copy of which you ought to have.

"COMMANDER" Transmission belting for Main power drive, Crusher, Screen, and wherever there is heavy duty.

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AKRON, OHIO



GOODRICH RUBBER BELTING FOR THE CEMENT INDUSTRY

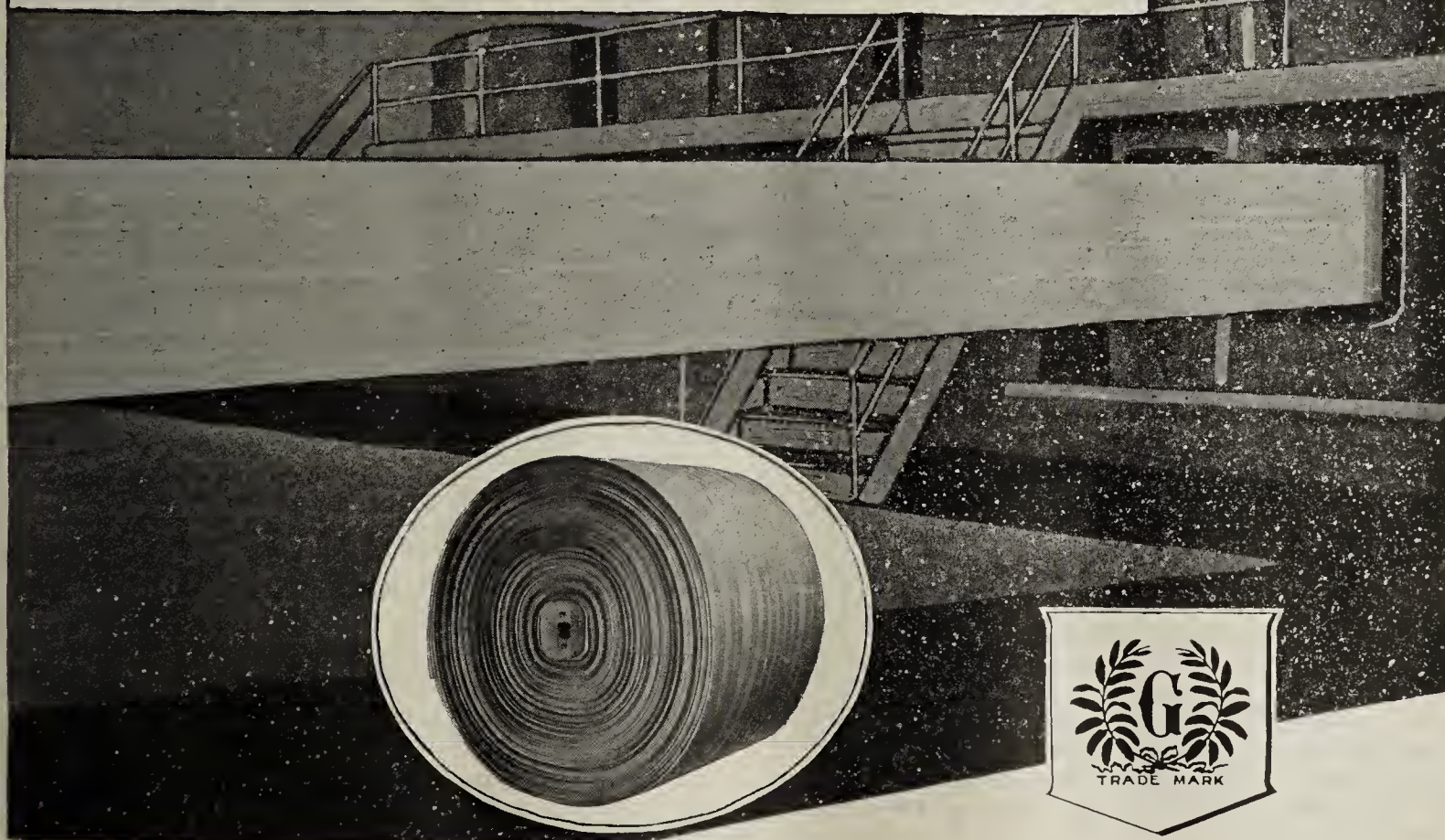
GOING after GRINDING RECORDS

Pull down that switch, and away she goes, picking up without fuss and transmitting the utmost energy available, from motor to mill.

That's typical of Goodrich "COMMANDER" belting. Pure rubber stock, frictioned so that the belt is practically stretch-proof, gives this famous brand of rubber belting a pulley-hug and flexibility of drive that reduces waste energy to a minimum, absorbing shocks and unequal driving strains.

In Cement Mills "COMMANDER" has made enviable records, standing the gaff of vertical or horizontal drives, amid dust and grit, and heavy starting loads. Goodrich experts have made a special study of your industries, and their co-operation on belting questions is without obligation—advice that may help lower the cost per barrel in your plant.

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The City of Goodrich—AKRON, OHIO



trucks are able to run down an incline into the excavation to a point alongside the steam shovel dipper, where they can be loaded directly. In most cases they can draw out of the excavation if the roadway is planked, without the assistance of a hoisting engine and cable which is necessary when horse wagons are employed.

Trucks Average 50 Miles Daily.—Each of the company's trucks averages about 50 miles a day and each truck gets between 2 and 3 miles to the gallon of gasoline. All of the 5-ton trucks are now equipped with 12-in. single tires in the rear. These have averaged more than 7,000 miles and have given better service than dual tires under the same conditions of loads and road pavement. The records of the company would indicate that a trifle greater gasoline and oil mileage are obtained by the use of the large single rear tires than with smaller duals.

The trucks are maintained in the Rodgers company's own garage and are in charge of one mechanic, who is responsible for all of the minor repairs. The drivers are not selected from among the ranks of the company's horse wagon drivers, but men are hired as truck drivers who have had previous experience operating commercial vehicles.

The drivers work 10 hours a day and are paid overtime for any services rendered after the close of the legal union day of 10 hours. No helpers are used on the trucks unless they carry supplies in small quantities, such as bags of cement or lime, which must be handled piecemeal to be unloaded.

Engines Overhauled Once in 2 Years.—So far it has been necessary to give the motors of the trucks a complete overhaul once in 2 years. By giving each of the trucks a thorough inspection every Sunday, and by attending to small repairs as soon as it becomes evident that the work must be done, it has been found that there is little necessity of taking down the entire chassis often than once in 3 or 4 years.

Breaking up Concrete

Concrete structures, either plain or reinforced, are considered of the most permanent nature. It is, however, often necessary to remove or destroy such structures. It may be an old concrete wall, bridge abutment or pier, a foundation under a building, the lining of a tunnel or an engine bed. Many times these objects are inside factory buildings and adjacent to valuable machinery, or the mass to be removed may be in close proximity to buildings, or to a city street congested with traffic or under an office building.

The customary method of removing old concrete so situated is by drilling holes with jumper steel and sledges by hand and then breaking off the material bit by bit with wedges. This is a very slow and expensive way to handle work of this kind. The best, quickest and cheapest method to remove old concrete, brick or masonry, is by blasting with explosives. At first thought, most people would immediately say that explosives could not be used, as they would crack the walls of the building above or damage nearby machinery and be altogether too dangerous. As a matter of fact, explosives can be used with great economy of time and money in almost all cases and with absolute safety. As a general rule, concrete is very easily broken by blasting, and experience has shown that the better the concrete, the more easily it can be broken.

In doing this class of work care must be exercised to see that the holes are properly located—which, however, is true of all blasting—and that light charges of explosives are used. It requires no particular cau-

tion or ability to blast old walls of concrete, brick, etc. that are located in open places, where there is little likelihood of damage to surrounding property. But it is in cases where the structures to be removed are located close to and often are a part of valuable property, machinery and buildings, that care and a nice sense of judgment must be exercised, and it is for such work that these instructions are written.

An explosive of relatively slow heaving action, like ammonia 30 per cent to 40 per cent strength, is best adapted for such work rather than a very quick and shattering explosive.

The drilling of holes is best accomplished by the use of self-rotating hammer drills, but when the size of the work does not warrant such equipment, holes can be drilled by hand, using jumper steel or hand drills and sledge. It is best to demolish the structure by gradual steps or benches, or a little at a time, especially if located inside or under a building. Holes are drilled, as a rule, from one inch to one and one-half inches in diameter, and in depth depending on the thickness of the material, although sixfoot holes are about as deep as should be shot in close quarters.

One of the concrete abutments under a bridge had become undermined and had fallen into the channel of the stream. The concrete block was straight for the width of the bridge and had wings at each end intended to brace and anchor it into the earth. The block was about three feet thick and seven feet wide, and was covered with about eighteen inches of water. The wings were sticking up out of the water and obstructed the channel.

Ammonia 40 per cent dynamite was used. The shot broke off the two wings and broke the center section in two parts. The blocks left by the blast were small enough to be handled by laborers, and were used as the foundation for the new abutment, built shortly afterward. The entire job took just one hour.

Removing Old Walls

If it is a vertical wall or abutment, probably the best way to crumble it would be to drill a vertical line of holes from top to bottom, spacing the holes three feet apart and three feet from the edge of the free side of the wall. The depth of these holes should be equal to three-quarters the thickness of the wall and a safe, yet efficient charge would be from one-third to one-half cartridge of 40 per cent ammonia $1\frac{1}{4}$ inches by 8 inches dynamite loaded in each hole. Each hole should contain an electric blasting cap and the wires of these should be connected in series and fired by means of a blasting machine. In this manner the object can be broken in sections.

Another method applicable when the wall is in the open and not adjacent to damageable property, is to drill a row of holes along the bottom of the wall about two feet from the ground and in depth equal to three-quarters the thickness. Holes should be drilled with a slight dip. A charge of one-half to three-quarters of a cartridge of 40 per cent ammonia dynamite $1\frac{1}{4}$ inches by 8 inches, should be loaded per hole and as many holes as desired fired at one time, unless in close quarters, when it would be best to fire two or three holes at a time. One row of holes so situated would be sufficient for a wall up to twelve feet high and from three to six feet thick. If higher than this, it might be best to shoot the wall in two sections, or use vertical rows of holes or load heavier charges per hole.

Brick walls crumble more easily than concrete, and do not require as heavy charges per hole, and holes can be spaced farther apart.

probably receive too little attention for the important part which they are called upon to perform. The aggregates should be carefully selected, both from a standpoint of their suitability for concrete work, as well as for their uniformity of color. Nothing is more to be regretted than a structure of concrete units in which all shades of color, ranging practically from light gray to a black, are discernible. This effect is far from pleasing to the eye, and becomes in time a serious handicap to the manufacturer of such products. Such disastrous combinations can be eliminated by judicious selection of materials. By the same judicious selection of materials, in the hands of a competent man, a variety of surface effects may be produced, the number being only limited by the taste of the manufacturer and the availability of the varied materials. Of late years the use of white Portland cement in combination with white sand and marble dust permit of some very pleasing and artistic effects.

In mixing concrete the same care should be followed, seeing that the water used is clean and free from alkali, acid or organic matter. Precautions should be taken to assure the same quantity of water to be placed in each batch of concrete that is made. If necessary, experiments should be conducted to determine that percentage of water which will give the best results in connection with the particular unit under consideration.

The hardening of the various products should be watched carefully. The ultimate success or failure of these products depends to a very large degree upon the care exercised in the hardening process. It is the height of folly to manufacture products of any kind and at once place them under the direct rays of the sun. Provision should be made whereby such products when manufactured during the hot summer months can be protected from the hot sun and wind, and at the same time provision should be made whereby such products may be kept thoroughly moist.

In the manufacture of what is commonly termed dimension stone, such as sills, lintels and caps, the forms used are usually manufactured to suit each particular piece of work. These can be made of wood, or, if the size of the contract justifies the expense, steel forms can be purchased.

One point should be carefully considered in the manufacture of units which will be called upon to act as beams supported merely at each end. The load to be carried by such unit should be carefully considered and due provision made for the placing of sufficient reinforcement to carry such loads.

In the manufacture of roofing tile, there are several patented types on the market today, each one of which recommends itself for use. There is a type of construction now being advocated, and which is meeting with some success, which for want of a better name is termed among those familiar with it as "concrete boards." These are thin slabs following something of a channel section, about 2 feet in width and made in lengths varying from 6 to 12 feet. These units are reinforced and show great strength and freedom from breakage in handling. They can be utilized for sidewalls, floors and roofs, and permit being made with any surface finish and color which might be desired.

It is an inborn trait of the American home-builder that he must spend a certain amount of money for outside beautification and decoration. The demand this year for ornamental concrete is greater than ever before. Large department stores in the representative cities of this country have established departments for

the showing and selling of ornamental concrete, such as urns, vases, benches and garden furniture of all descriptions. It is possible with but slight additional expense to the home-builder to provide himself with one or more pieces of ornamental concrete, which will add greatly and in a decorative manner to his concrete home. The alive and up-to-date concrete products manufacturer will take advantage of this tendency for decoration and secure distinctive molds whereby decorative units may be made.

It is impossible in the confines of this short article to go into any detail concerning the various structural features whereby the complete home of concrete is a possibility. This magazine, together with the Portland Cement Association, Conway Bldg., Chicago, feel they are offering their services not alone to the interested home-builder, but to the manufacturer of concrete products when they urge inquiries be addressed to them concerning any of the features and details of a structure of this kind.

Chalmers & Williams, Inc., Establish Service Department

Chalmers & Williams of Chicago Heights, Ill., have established a "SERVICE DEPARTMENT" for all types of Crushers and other products manufactured by them.

This department is under the supervision of Mr. J. F. Orr, sales manager, with Mr. J. I. McInrue as field representative.

Mr. McInrue has long been in the service of this company and has grown up with them and knows all of the details of the construction and operation of each and every machine.

"We feel that with the large number of our Crushers now in the field, the experience as obtained by us in the construction of these machines together with the experience of the different operators should be of considerable value to each operator, writes A. H. Coxhead, advertising manager. Numerous little changes and improvements are being made continually in all types of crushing machines, both in the shop and by the operator, and these little changes and improvements if known to each operator oft-times results in the saving of considerable time and labor. It is with this idea in mind that we are sending Mr. McInrue into the field to acquaint the different operators with the experience we have had in the construction of the machines and also spread any information which can be gathered in the field regarding the operation of all types of crushers and which is not always known by the manufacturer, as very often an operator makes some little change or addition to a machine which would not be thought of by the manufacturer. Little difficulties may arise and by the attention which can be given by an expert these difficulties are very easily overcome."

Mr. McInrue will make visits to the Rock and Gravel plants throughout the country so as to see the crushers in operation and make sure that they are operating to the highest point of efficiency that they should.

This service, we believe, will be appreciated not only by the present operators of the Chalmers & Williams and Symons Disc Crushers but also by the future purchasers of these crushers.

The watchword of the times is "SERVICE", and we believe that the plan we have outlined will be of immense value to the stone and gravel producers."

Weighing Concrete Materials Saved Cement on Three Big Dams

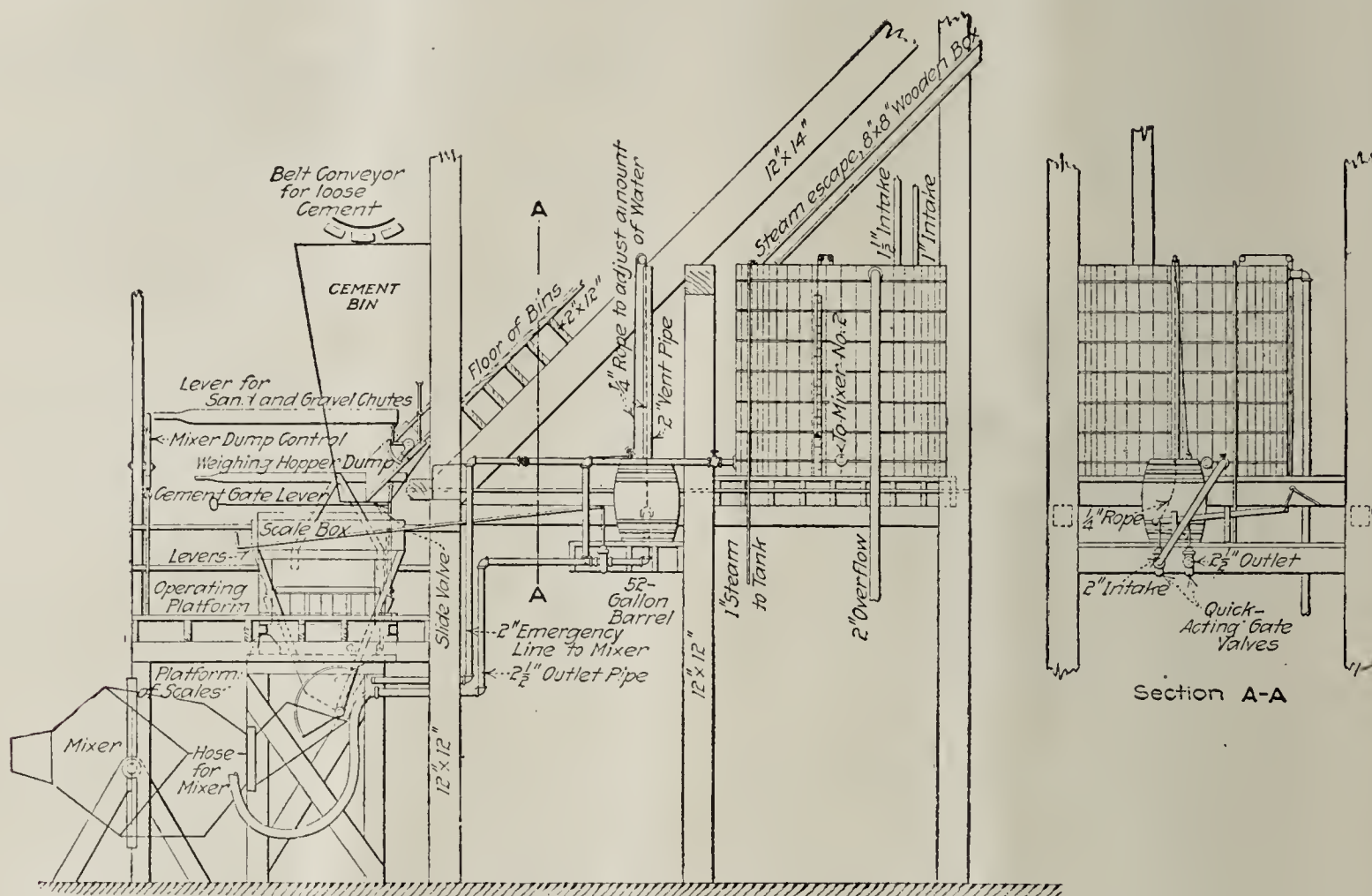
Cost of Equiping Mixer Plant for Weighing Not Excessive—Proportioning by Weight Gave Better Concrete with Less Cement and Without Loss of Speed

By H. H. Hunt
Fargo Engineering Co., Jackson, Mich.

Concrete proportioned by weighing the cement, sand and gravel reduced the volume used on three hydro-electric developments completed recently in Michigan and Minnesota. For a total of 130,000 cu. yd. of concrete placed, the cement used per cubic yard ranged from 1.18 to 1.23 bbl. Void tests and occasional changes of the relative weights of the component materials kept the mixture uniform. Making the operations of the mixer plant as nearly as practicable all-mechanical the labor force was not increased and there was no appreciable loss of time due to the more exact methods of proportioning by weighing. One design of mixer plant was used for all three jobs.

tions were dependent upon the voids found in the sand and stone, and on account of the varying values of voids to be expected it was considered desirable to have a ready means of changing the relative amounts of sand, cement and stone. It was, therefore, decided that all material should be weighed so that any desired proportions could be obtained with a minimum of trouble. While this method has been used previously in a few cases, because of the exceptional success obtained here, and the volume of concrete amounted to 21,000 cubic yards.

The concrete specifications for these three developments, a description of the plant layout, together with an out-



MIXER PLANT DESIGNED TO BE KNOCKED DOWN AND REASSEMBLED — ALL OPERATIONS CONTROLLED BY LEVERS FROM ONE PLATFORM

In 1917 and 1918 the following hydro-electric plants, for which the Fargo Engineering Co. were designing and supervising engineers, were completed and placed in operation: Wissota dam, near Chippewa Falls, owned by the Wisconsin-Minnesota Light & Power Co.; Junction dam near Wellston, Mich., and Foote dam near Oscoda, Mich., the two latter dams being owned by the Consumers Power Co. Wissota dam was of 60-ft. head and comprised 61,000 cu.yd. of concrete; Junction dam was of 50-ft. head and contained 47,600 cu.yd. of concrete, while Foote dam was of 35-ft. head. Plans were drawn in such a manner that the propor-

line of the steps involved in the determination of proportions, is of interest.

Details of the mixing plant used in constructing the Foote dam are shown by the drawings. This plant layout is typical of those at the other two jobs, though each differed from the others in details. The following description refers especially to the Foote dam operations.

Sand and stone from the dump cars were unloaded into the boots and elevated to the overhead bins by means of continuous bucket elevators 71 ft. 6 in. long, each elevator being provided with an individual motor

drive. The capacity of the storage bins was 80 cu.yd. of sand and 160 cu.yd. of gravel, it being considered advisable to have enough material in storage so that a break down in the transportation system would not seriously interfere with the continuity of concreting operations.

As an additional insurance against shut downs, storage piles of sand and stone were provided adjacent to the mixing plant and a stiff leg derrick handling a clamshell bucket was so located that it could take material from storage and place it in the boots of the bucket elevators. The use of these storage piles made it possible to transport screened sand and stone at a more uniform rate than could have been done if dependence had been placed upon the storage capacity of the bins only, inasmuch as at such times as the mixing plant was not in use, transportation of materials from the screening plant would have been stopped when the bins were filled. As it was, a uniform output at the screening plant could be maintained, excess material over that used on any given day by the mixing plant being placed in storage, and, conversely, being taken from storage on those days when the output of the mixing plant exceeded the capacity of the screening plant. Steam pipes were provided in each bin to prevent freezing of sand and stone in cold weather.

When the mixer plant was in operation cement was loaded onto a push car and transported to a dumping pocket located over the lower end of a belt conveyor. The sacks were emptied into this pocket and the empty sacks were stored in a small shed nearby. Before being bundled for return to the cement mill the sacks were placed in a cleaning machine and thoroughly shaken. The dumped cement was taken by the belt conveyor and discharged into a bin located at the front of the sand and stone storage bins and directly above the charging hoppers of two cube mixers. Sliding cut-off gates were provided on the cement bins and proved very satisfactory.

The charging hopper of each mixer was supported on the framework of a Standard hopper scales provided with a four-beam charging box. Three of the beams were graduated to 1600 lb. by 5-lb. intervals and one beam to 3000 lb. by 10-lb. intervals. In operation, only three of the beams were used; one each for cement, sand and stone. A testing engineer was responsible for setting the scales to give proportions which tests showed were required under the specifications, and after setting the beams the charging box was locked.

The various scales were placed in operation by means of levers projecting through one end of the box. Under this arrangement the man on the charging platform would throw a lever to place the beam for stone in operation and would then admit stone to the charging hopper until the beam balanced, when the cut-off valve was closed. In the same manner cement and sand were added. If through carelessness too much stone or sand was added, a correction was made by means of a plus or minus attachment so that each batch contained the computed amount of cement.

Water was supplied to the mixers from an elevated tank which was provided with an adjustable discharge pipe by means of which the amount of water supplied to the mixer could be regulated or maintained constant. A steam connection was provided by means of which water could be heated in cold weather.

The number of men required for operating the mixing plants was as follows: Operating cement conveyor, 1 man; sand and gravel bins, 3 men; charging mixers, 2 men and operating mixer, 2 men. In addition there was a gang of men who transported cement from

storage to dumping pocket.

After being dumped into hopper bottom cars the concrete was hauled or pushed to the forms on a narrow gage track on an overhead trestle, though some concrete was spouted directly into place. A kerosene burning locomotive was used for hauling cars and proved entirely satisfactory.

Costs of plant construction, including equipment for proportioning, are given for the Junction dam plant as follows, based on 1916 prices:

PORTABLE SCREENING PLANT

Labor:	
Framing timbers, 140 hr. at 35c.....	\$ 49.00
Erecting bins, 1,210 hr. at 35c.....	423.50
Placing screws and motors, 150 hr. at 35c.....	52.50
Installing elevator (estimated).....	50.00
Total labor	\$575.00
Material:	
9,200 ft. B. M. timber at \$33.....	\$303.60
3,500 ft. B. M. plank at \$24.....	84.00
1,130 lb. bolts and rods at 6c.....	68.00
780 lb. sheet metal at 8c.....	62.40
2 bin gates at \$22.....	44.00
8 track wheels at \$20.....	160.00
2 revolving screens, 42 x 14 in.....	1,018.00
1 bucket elevator, 35 ft. centers	830.00
Total material	\$2,570.00
Grand total	3,145.00

BINS AND MIXER PLANT

Labor:	
215 hr. framing timbers at 35c.....	\$75.00
1,945 hr. erecting bins at 35c.....	875.75
780 hr. erecting bins at 25c.....	
120 hr. building house at 35c.....	57.00
60 hr. building house at 25c.....	
240 hr. setting scales and mixer at 35c.....	140.00
120 hr. setting scales and mixer at 25c.....	
Concrete footings, 27 cu.yd.....	28.50
180 hr. heating pipes in bins at 30c.....	99.00
180 hr. heating pipes in bins at 25c.....	
Elevators and belt conveyors (estimated).....	200.00
Total labor.....	\$1,458.50
Material:	
Pipe, etc., for heating system.....	196.00
2,700 lb. sheet steel at 8c.....	216.00
3,500 lb. bolts and rods at 6c.....	210.00
4 bin gates at \$22.....	88.00
Concrete for footings.....	140.00
14,000 ft. B. M. plank at \$24.....	336.00
15,500 ft. B. M. timbers at \$33.....	511.50
Total material	\$1,697.50

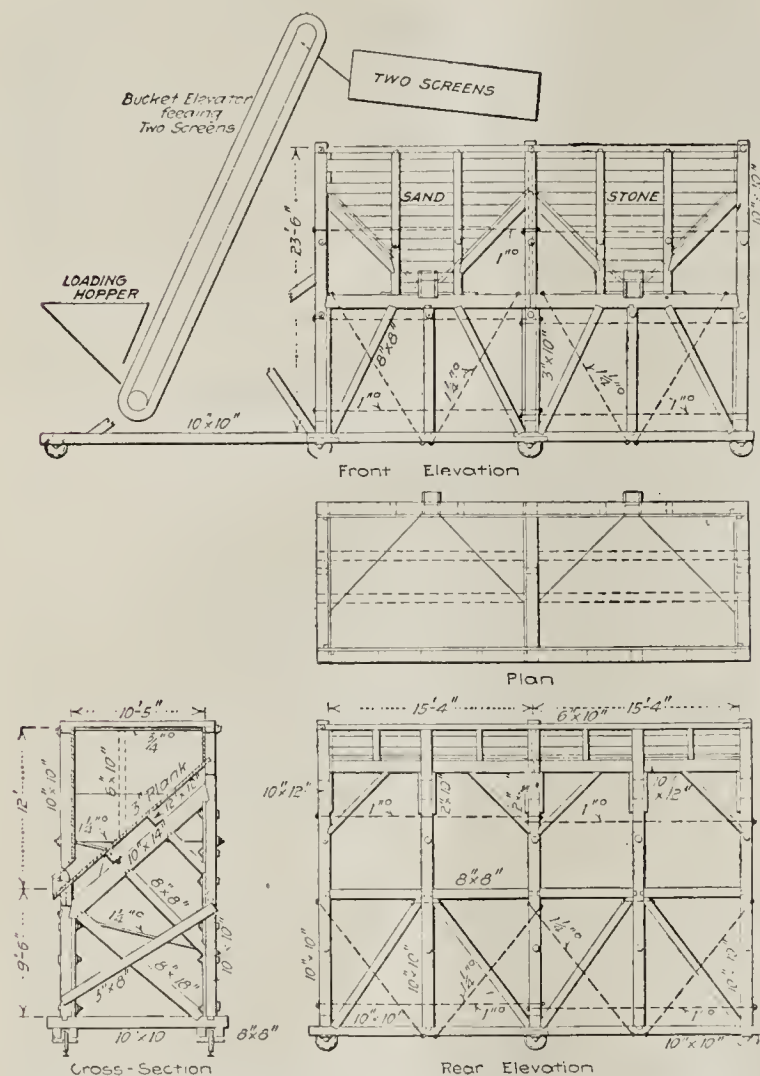
Equipment:	
71½ ft., 18 in., 4-ply belt.....	400.00
3 No. 4 elevators.....	2,000.00
2 No. 1618 Standard hopper scales.....	280.00
2 Mixers	2,300.00
Total equipment	\$4,980.00
Grand total	\$8,136.00

It should be noted that the above plants are so built that they can be used on future work at slight expense for moving and re-assembling so that the figures given do not represent the amounts to be charged against any one development.

Sand and stone for all three developments were obtained from nearby deposits of bank gravel of which 2% was retained on a 1½-in. screen and 40% on a ¼-in. screen, and 58% passed a ¼-in. screen.

All gravel was excavated by steam shovels or drag line excavators and screened into sand and stone bins using vibrating screens in one plant and revolving screens for the other two. Though the vibrating screens required more repairs than the rotary screens, the results obtained, especially in damp weather, were more satisfactory, as it was found almost impossible to keep the rotary screens from clogging after rains. Portable screening plants were used at two points. Electric power operated belt conveyor and screens.

Cement in cloth sacks was used for the Michigan jobs being unloaded from cars directly into a storage shed having a capacity of 10,000 bbl. and located in close proximity to the mixing plant. Each carload was kept in a separate pile and marked with car number and date received. Bulk cement was considered, but a decision was made in favor of the use of cement in cloth sacks because it was found that it would be easier to obtain the latter from mills within a reasonably short shipping distance. At Wissota dam, however, bulk cement was used with very satisfactory results as to economical handling.



PORTABLE SCREENING PLANT PREPARED PIT GRAVEL FOR EXACT PROPORTIONING

A testing engineer, reporting to the resident engineer, was placed in charge of void tests from which concrete proportions were computed. After setting the scale beams to produce the proper proportions this assistant engineer made frequent inspections to make certain that mixer attendants used proper care in balancing the scale beams. As all work was being done by the owners, the presence of a concrete inspector at the plant continuously was not considered necessary, but such inspection should ordinarily be provided on contract work. Frequent tests were made of voids in sand and gravel as they arrived at the job and when

it was found that void percentages had changed, the mixer scales were re-set without interference with concreting operations. This method of charging the mixer hoppers worked out very well and a much more uniform mixture of concrete was obtained than was possible where proportioning was done by levelling to marks in the charging hopper.

Samples of concrete were taken from the forms at frequent intervals and poured into 8-in. cylindrical molds 16 in. long. These cylinders were stored in damp sawdust or sand and were later sent to a laboratory for tests of compressive strength when 30 days old. The results of these tests were satisfactory and showed that the methods of proportioning and mixing were such as to insure good concrete. Occasionally a low crushing strength would be shown but it was usually found that this was due to the presence of a stone pocket in the cylinder. In addition to taking sample cylinders for testing, frequent 1:3 briquet tests were made at the job as a check on cement tests made before shipment.

In order to determine the advisability of using waterproofing material in concrete subjected to water pressure a series of tests were made of the permeability of concrete mixed according to different proportions. Blocks of concrete were made, nine different proportions being used. The tests showed that there was no reason to expect seepage under heads up to 50 ft. if mortar for concrete was mixed even as lean as the proportions of 1:2 7-10 by volume. The tightness of the finished concrete which is subjected in some cases to a head of 40 ft. is a satisfactory confirmation of the conclusions resulting from the permeability tests on small samples.

The screening and mixing plants described were used on work involving the mixing and placing of approximately 130,000 cu.yd. of concrete. It has been demonstrated that proportioning by void determination insures excellent concrete with less cement than required to obtain concrete of equal quality with predetermined, fixed proportions. The amount of cement used per cubic yard of concrete ranged from 1.18 to 1.23 bbl. on the several jobs where use was made of the proportioning methods described above. The use of scales for charging the super-hoppers of the mixers was essential to provide for convenience in changing proportions from time to time and furthermore it made almost certain the absolute uniformity of successive batches, since it obviated the difficulty of measuring volumes by bringing the several materials to fixed points in a hopper.

While the quantities of concrete involved are greater than found in the average case, there is no question that void determination and the use of scales would work out very satisfactory on comparatively small jobs. In cases where it is desired to adhere to the usual method of arbitrarily selecting fixed proportions the use of scales would still be of great value in insuring uniformity of mixture and preventing disputes as to the use of the proper amount of sand, stone or cement.

The details of this system of proportioning and weighing concrete ingredients were first developed by J. D. Justin, resident engineer for the Fargo Engineering Co. at Wissota dam. H. N. Tuley was resident engineer at Junction dam and F. W. Howard was resident engineer at Foote dam, being later succeeded by Holton Cook. The writer is construction engineer with the Fargo Engineering Co. and the mixing plants at Foote dam and Junction dam were designed and built under his direction.

Machine Finishing Concrete Roads

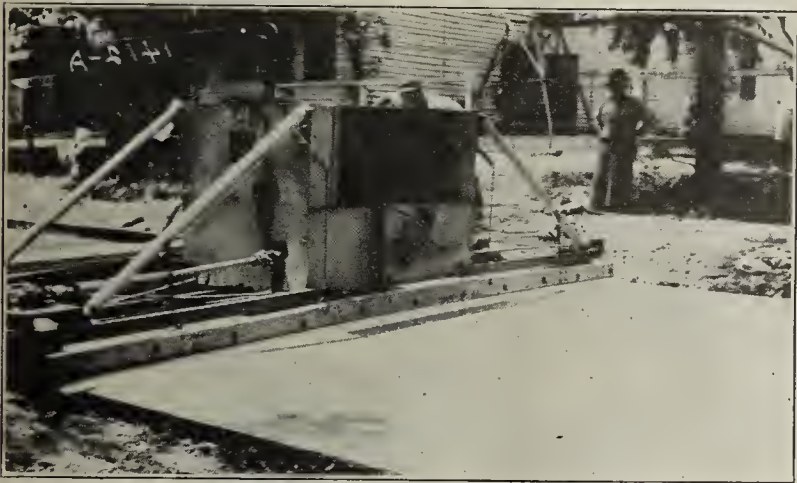
By E. G. Carr

A concrete road may be defined as a slab of concrete upon a country roadway to provide a hard surface for traffic under all weather conditions.

It will be assumed in this article that the slab has been properly designed with reference to the character of the soil and the traffic to be carried. These problems must be solved by the knowledge and experience of the engineer. It is the object of this article to direct attention more particularly to the character of the concrete slab and its construction.

Concrete in roads is subjected to more severe conditions than are ordinarily encountered when it is used for other purposes—abrasion of the surface and the pounding effect of traffic which causes strains not common in other concrete structures.

A continuous slab of concrete on country soil is also subject to expansion and contraction caused by changes in temperature and water absorption. Hence, concrete for roads must be better concrete. It must be more dense and uniform than for most other uses. A small amount of inferior concrete in a wall may be protected and supported by the stronger concrete surrounding it. In a road the traffic hunts out the weak spots with fiendish ingenuity, and these places will fail regardless of how good the surrounding concrete may be.



The Machine Spreads, Tamps and Finishes the Concrete. The Tamber Strikes Ten Times in Its Own Width.

Concrete cannot be compressed like a bale of cotton, and it can be compacted only by creating a flowing or crawling action in the concrete mass, so that the larger aggregate will settle closer together, and the smaller particles will fill the remaining voids.

There are three ways common in molding concrete to reduce voids. Two are detrimental and one beneficial to the strength of the product and all three generally employed in varying degrees.

One way is to add excess water until the concrete literally flows in place by gravity. Another method is to use finer aggregate so that there will be less voids to fill. The third way is to stir it, tamp it, roll it, shake it or anything to move the more loosely arranged aggregate so that they will fall into closer and more compact position.

The use of excess water impairs the strength, makes the concrete porous and causes the lighter material to float at the top and cover the surface with laitance and foreign material, which may have found its way into the mixture. In some concrete structures there is an advantage in having the best concrete at the bottom, but it is evident that the best concrete should be at the top of a road.

Engineers have long known that an excess amount of water used in mixing will cause a considerable loss of strength in the concrete. Exactly what ratio exists between water content and strength has recently been shown by the extensive investigation of Professor D. A. Abrams of Lewis Institute, Chicago. The accompanying curve gives the results of his experiments.

The use of too much water cannot be blamed unreservedly on the contractor because heretofore methods had not been developed for the practical use of stiff concrete for roads.

The size of the aggregate governs largely the amount of water needed to give a workable concrete. The smaller aggregate requires more water.

If a road were built of a rich mixture of cement and fine aggregate, the cost would be excessive and the expansion and contraction would be greater than if the mixture of fine and coarse aggregate had been used. Moreover, when a contraction crack forms in a concrete road, the coarse aggregate dovetails the slabs together, holding them in their original relative position.

The greater the proportion of good, clean stone, mixed in a given consistency of cement mortar without forming voids, the better the concrete will be for roads.

While concrete used for building roads presents more than the ordinary disadvantages to the use of excess water or fine aggregate, it offers exceptional opportunities for mechanical compacting on account of its accessibility.

The method of applying force in mechanical compacting must be such that the larger pieces will not be displaced after they have settled to their best relative positions. The applied force must not drive a stone past the best place for that stone to stop, and the only available means for stopping that stone at the right place is the increased resistance offered to the movement of the stone by a more compact mass than the mass in, and with which the stone is moving.

Assume that we have an agitating force with a limited violence or a tamper with a given stroke. A greater frequency of strokes enables us to make a stiffer concrete flow.

It is this principle—the rapidity of agitation—which yields the unique advantage that mechanical tamping has over hand work.

Under a rapid succession of strokes, the concrete literally flows as a result of the agitation and the mass is in a semi-liquid condition. The drier and coarser the concrete, the less it will move under the influence of a single stroke, and the sooner it will be at rest again. To obtain the advantage of a moving friction, the succeeding stroke must come while the concrete is still in motion.

Voids in concrete are a source of weakness and, if beneath the surface, may not be detected until the ravelling of the aggregate under traffic exposes them. Therefore, the effect of the agitation must be in all directions and the agitation must be continued and repeated until there is a reasonable certainty that the desired result has been accomplished.

Starting with these ideas, the writer developed the concrete road finishing machine shown here.

After numerous experiments it was found to be exceptionally advantageous to utilize suction for the purpose of agitating the concrete mass.

If the concrete in walls, for example, be agitated, it will be noticed that the concrete near the surface is

easily shaken into shape while it is difficult to produce any movement in the bottom of a deep layer of concrete, on account of the weight of the concrete above. This is so obvious that it would seem to be unnecessary to direct attention to it. Any additional pressure in the direction of the force of gravity tends to bridge, arch or bind the aggregate in the positions assumed under the force of gravity instead of facilitating any movement in the mass that would rearrange the aggregate into more compact positions. A keystone of an arch is not displaced by downward pressure upon it.

It was found that by creating a vacuum above the concrete mass in one place, mortar was forced towards the vacuum space, disrupting the binding of the aggregate, and permitting the pieces to settle into more compact positions—hitting the keystone from the bottom so to speak. The idea can be well illustrated by a log jam. Force applied to the up-stream side of the jam only wedges the mass more firmly; it would be readily broken by pressure applied below the jam by a reversal of the current.

In the machine illustrated, the suction is obtained by the tamper templet, which is raised with a jerk after hitting the concrete—alternately driving the concrete away and jerking it back. This action removes the entrapped air, giving a dense concrete.

The machine illustrated is so constructed that the speed, length and intensity of the strokes can be varied at the will of the operator to meet all the different consistencies of concrete and conditions found in road work.

A laborer tamping concrete, would pass over the surface if it appeared finished. The machine tamps thoroughly and uniformly. As it works forward and backward, it attacks a bad arrangement of aggregate, first from one direction and then from the other, insuring a slab of uniform density.

Besides the advantages of more thoroughly and uniformly compacted concrete, machine finishing is a more dependable means of obtaining a true, even surface,—thereby reducing the vibration and wear on the pavement and vehicles.

Quick-Make Starting Switch

One of the new equipments brought out by the Westinghouse Electric and Manufacturing Company during the past year is an interesting starting switch. The switch is designed for use where squirrel-cage motors are started with a full line voltage. The switch is known as the Quick-Make (and quick-break) Starting Switch (Type 816). Its characteristics are 10 to 100 amperes, 25 h. p. maximum, three-phase, 220, 440, and 550 volts.

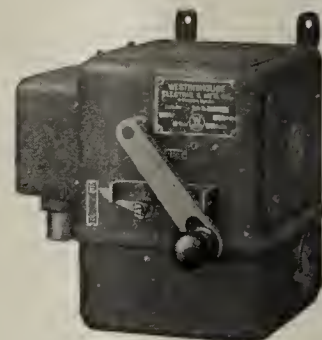
This switch is extremely flexible in its applications; in addition to being a motor starting switch it can also be used to control feeder circuits; it may be supplied in any of the following combinations, each having the "quick-make and quickbreak" feature, for either hand or shipper-rod operation:

- (a) Non-automatic switch.
- (b) Switch with low-voltage protection.
- (c) Switch with inverse time element overload protection.
- (d) Full automatic switch with low-voltage and inverse time element overload protection.

It is especially suitable for shipper-rod operation on account of the positive action of the contacts. It is impossible for the operator to retard the motion of the contacts after they have started to close—there can be no "teasing" of the contacts. Workmen who

are accustomed to starting machines from line shafting by means of shifting belts have no confusing details to learn. They may start the motor-driven machine with the same starting motion they use in shifting belts.

Contacts are opened and closed in oil, thus effectually suppressing arcing. The contact is made or broken so quickly that the eye cannot follow the motion. A rolling action confines the arc to the tips of the contacts and prevents pitting or roughening of the seating parts where final contact is made. A strong spring holds the contacts firmly in the closed position. These features result in greatly prolonged life for the contacts.



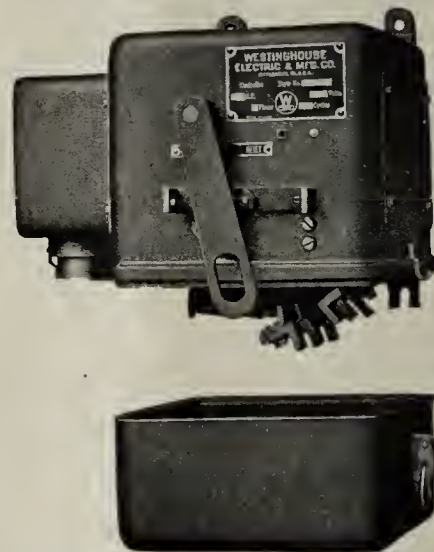
Westinghouse Quick-Make Starting Switch

Construction.—Drawn-steel construction is used, giving maximum strength with light weight, and assuring uniformity and interchangeability when new parts are needed for replacement or repairs. The oil tank is supported by snap ring-latches. Removal of the tank clearly exposes the contacts and makes them easily accessible. When necessary to replace contacts each may be removed by taking out a single screw.

Contacts and contact supports are of the same construction used for Westinghouse type A auto-starters and magnetic contractors. This minimizes the number of spare parts that should be carried.

These starting switches are dust-proof.

Openings are provided for conduit wiring into the top of case; terminals for connecting motor and line wires are accessible when cover at top of starter is removed.



Westinghouse Quick-Make Starting Switch with Tank Lowered Showing Accessibility of Contacts

Micarta insulation is used throughout.

Overload and low-voltage attachments may be added with no change in switch mechanism, as the toggle trip is common to all combinations of this switch.

Low-Voltage Protection not only opens the contacts on failure of power, but makes it impossible to close them again until return of voltage. Since the low-voltage coil is connected in the line circuit continuously, means have been provided to close the armature of the low-voltage circuit when the switch is in the "off" position, thereby giving protection to the coil and preventing burn-outs. A safety stop may be provided by connecting one or more push buttons in series with the low-voltage coil.

Overload Relay.—The overload relay is the same as that used on Westinghouse type A auto starters. It has the inverse time element feature and is equipped with a regulating device, adjustment of which controls the degree and duration of the overload possible on a motor or feeder circuit. This adjustment can be made without operating the switch cover.

Hand Reset.—This is an additional safety feature which makes it necessary to set the mechanism before the switch contacts can be closed. Whether the contacts have been opened through the operation of the low-voltage coil, the overload relay, or by moving the switch handle to the "off" position, it is impossible to close them again until the switch handle has been moved to the "reset" position. Thus protection is afforded workmen and valuable machinery which might be injured by accidental starting of the motor.

Automatic Feed for Pulverizer; Other Operating Points

The American Pulverizer Co. has placed on the market a patent piston feeder, which, it is claimed, will feed exact quantities of stone from 5-in. size down to dust. The following points on operation are volunteered by the same manufacturer:

"The most troublesome part in a grinding plant is always the handling of the crushed rock. The best suited place therefore, for a pulverizer is under the return of the over size from the crusher and the dust spout, with a small bin on top of the automatic feeder to equalize the work. When material from the dump piles is to be used, the pulverizer is placed underground in a concrete pit so that the top of the feeder is about 12 in. below the ground. The pit is covered and the material brought to the feeder by a scraper or belt conveyor. The pit under the grates should be 12 in. lower than the base of the machine and of 50 to 60 deg. pitch. The incline should be trough like and covered with sheet iron to decrease the friction.

"The elevator for the ground product should be as high as possible and a stationary screen should be placed under the head spout. It is advisable to use a double screen of which the heavier mesh is placed below the finer mesh and the upper part left free from the finer mesh. When using the finer mesh a sheet iron cover is inserted so that the elevator passes the material to it. When the limestone is damp and the finer screen starts to clog, the sheet iron is removed and the limestone is passing under the fine screen through or over the heavier one. Any material larger than the screen mesh is passed into a chute and returned to the pulverizer by gravity and the finished material is passed into another chute and into the cars or bins.

"When storage is required the most economical way is 'open storage' by screw or belt conveyor, where it can be loaded into cars later by hand or steam shovel. Adequate bin storage is impossible as the business of the fall season is requiring thousands of

tons in storage for larger companies. The cost of production varies from 15 cents to 30 cents per ton of the finished product required. The horse-power per ton is 5 to 6 and the up-keep of the grinding machinery 3 cents to 4 cents based on 2½-in. rock fed to the machines.

Big Jobs for Dynamite

Many thoughtless people imagine there will be no further use for powder factories now that the Germans have been properly licked.

They do not realize that nearly every industry in the world is directly or indirectly dependent on explosives. Name the industries that do not use coal, iron, steel, stone, copper, or some other metal. How would we produce these raw materials without explosives?

There are two big jobs for dynamite looming up just ahead—one on each side of the Atlantic. Millions of pounds of the explosive will be required to do the work.

It is proposed to tunnel under the English Channel connecting England and France and making unnecessary the dreaded trip by boat across the famous choppy old channel.

'Tis said that a man immune to mal de mer on ordinary waters will oftentimes succumb to it on the little journey across the Channel. Once the tunnel is completed, authors of sea stories will lose one of their most prized themes. A sea story without some humor injected into it via the land lubbers' stomach troubles while crossing the Channel will be as tame and unnatural as a Wild West story with the Indian left out.

This tunnel (to be exact, there are two parallel tunnels, each thirty-one miles long) will necessitate going through sixty-two miles of gray chalk. To do that will require as great a quantity of explosives as was needed to annihilate a Hun Division of Infantry. Of course, it will be a different kind of powder, but it will be powder just the same.

The big job on our side of the puddle will be a vehicle tunnel under the Hudson River connecting New Jersey and New York. When finished, it will no longer be necessary to drive your auto or truck on to a ferry boat in order to get from little Jersey to big York. This is a blessing everyone will appreciate.

The Hudson tunnel will also consume many weeks output of the dynamite factories.

From the foregoing, it will be seen that the explosives manufacturer is not going out of business just because Kaiser Bill's war has collapsed. In fact, it is a safe bet that every powder maker on earth prefers peace profits to war profits.

Phoenix Cement Co. Has Annual Meeting

The stockholders of the Phoenix Portland Cement Company recently held their annual meeting at Nazareth, Pa., and elected the following directors: J. W. Walker, Port Kennedy, Pa.; C. F. McKenzie, Pittsburgh; L. C. Morton, Philadelphia; J. C. Parsons, Phoenixville; C. B. Haubert, Nazareth. The board organized by electing the following officers: J. W. Walker, president; J. C. Parsons, vice president; C. B. Haubert, secretary; A. W. Marsh, Jr., of Philadelphia, treasurer.

The reports made indicate that there is a prosperous season ahead for the company. The interest was paid on all the outstanding bonds.

Quarrying Sandstone in Minnesota

The accompanying illustration indicate a large and well equipped stone producing plant.

They do not deceive, for it is the quarry and plant of the Kettle River Company at Sandstone, Minnesota.

This plant produces about 10,000 cubic yards of Kettle River sandstone each year at the rate of 50 cubic yards a day, which it handles by means of derricks, a system of railroad tracks, cars and locomotives, and a recently installed Leschen cableway, which is shown in the illustration.

This cableway has a 650-foot span and a 5-ton capacity. It serves the crushing plant with stone from the quarry.

In addition to the above mentioned equipment for the handling of stone, the company operates a full series of necessary air tools for "outsing" the stone and has a fully equipped cut stone plant. Electric power is used.



Stone from the Ledge is Carried to the Crusher on the Left by Means of the Cableway. Derricks are Used for Handling Building Stone, etc.

The material produced at this plant is building stone, paving, curbing, crushed stone, and stone for railroad ballast.

After material has been passed through the crusher it goes to storage bins from which it can be emptied into Great Northern Railway cars. Building material, etc., is loaded on cars by means of derricks.

Nevada State May Refine Cement

The state of Nevada may engage in the manufacture of cement as a part of its highway construction program, a bill appropriating \$100,000 for that purpose having recently been approved by its legislature. The bill was written into law after a special commission appointed by the governor had made an investigation of the practicability and economy of manufacturing cement within the state, and reported favorably.

The law creates a commission of three persons who are given a fund of \$5,000 with which to make further investigations and experiments. If deemed wise they are authorized to proceed with the erection and operation of the plant from a further fund of \$100,000 placed at their disposal.

The special commission will be appointed within a few days by Governor Boyle, and will at once begin investigations with the mineral deposits that abound throughout the state.

Illinois Cement Producers Meet to Discuss Problem of Safety in Plants

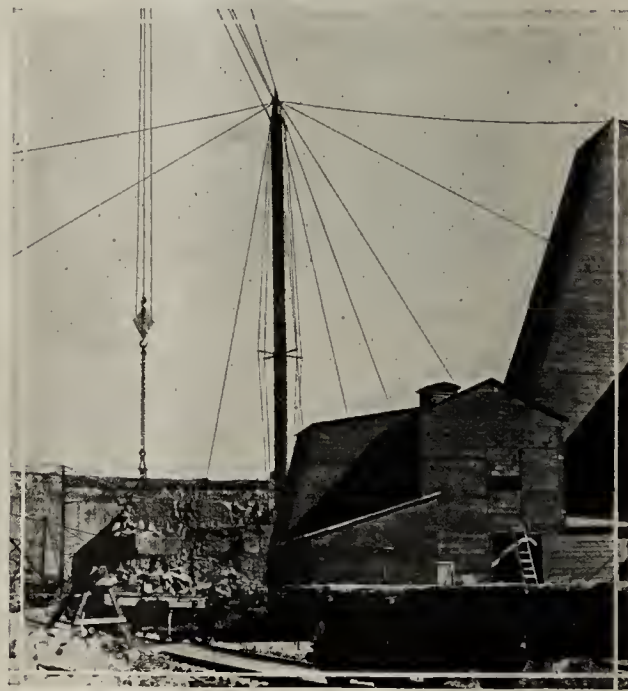
A meeting for the discussion of safety problems at the various cement plants in Illinois was recently held in the club rooms of the Manufacturers' Club. The session was called by the Portland Cement Association Bureau of Accident Prevention and Insurance of which Mr. Jacobson is manager.

About eighty-five delegates attended the meeting. These include men from the Lehigh plant, the Marquette, the La Salle, the Universal plant at Buffington, Ind., the Dixon plant of the Sandusky company, and the Hannibal, Mo., plant of the Atlas company.

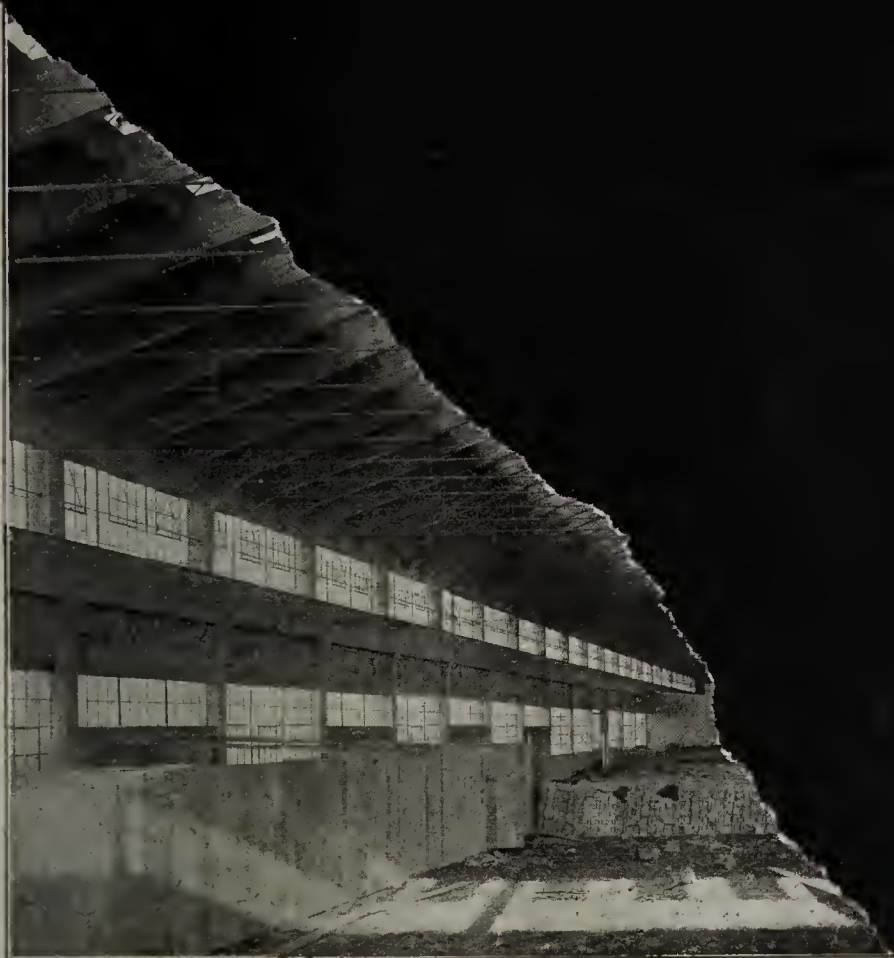
Castalia Cement Plant

The report of George W. Hackett of Pittsburgh, receiver for the Castalia Portland Cement Company,

shows that since he assumed charge of the business of the company three years ago, he has succeeded in wiping out all obligations and indebtedness of the company and has, in addition, accumulated a net profit of about \$500,000. The company has now been returned to the stockholders.



The Cableway Bucket for Handling Stone to Crusher



Interior View of New Reinforced Concrete Factory Building

anchored

ched this month
company's yard,
York. The ves-

18,
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33, or
ue. The
4,000 brick,
\$172,090, or 46
nesota, which pro-
\$90,212, was second
the average price per
brick in 1918 was \$8.94,
1917; that of face brick was
9.36 in 1917.

Gyratory Crusher Built at Allentown, Penn.

Reported to be the largest gyratory stone
ever built has just been completed in the shops
Taylor Engineering & Mfg. Co., at Allentown,
The machine is to be used for crushing lime-
for chemical purposes, flux, etc. It has two jaw
ings each 60x190 in. and an estimated capacity
2500 tons per hour, reducing to 8 in. The crusher
plete weighs about 800,000 lbs., is 17 ft. 8 in. high
om foundation to top of hopper and has a shaft 21
t. long and 40 in. in diameter.

Whalen Culvert Form

The Whalen Form for concrete highway culverts,
made by E. J. Whalen, Syracuse, N. Y., is the subject
of a little book just issued, the word of which
says that its purpose is to give a fair and accurate rec-
ord of the cost of two materials used for drainage in
building our highways. Illustrations, letters, reports,
etc., tell the story, the pictures being excellent half-
tones. A reproduction of a photograph of E. J. Whalen
is inside the front cover.

THE COMBINATION OF

DODGE

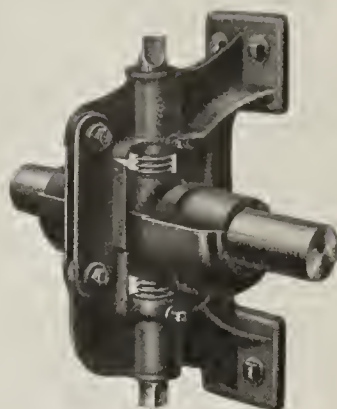
ONEIDA and KEYSTONE

products mark a new era in the world-wide distribution of power transmission products.

Oneida and Keystone products are Dodge built; standardized and interchangeable with other Dodge products.



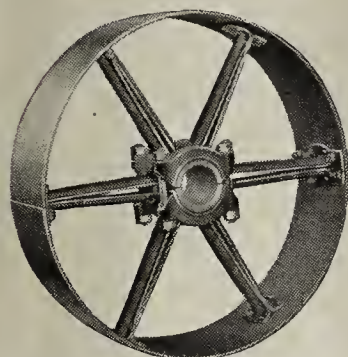
Dodge Adjustable Hanger (Drop Type) with Self-Lubricating Bearing.



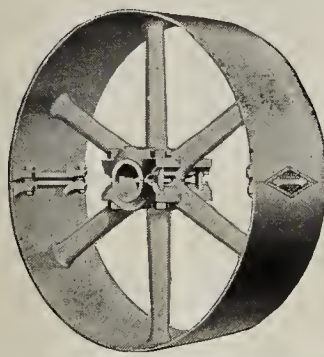
Dodge Adjustable Hanger (Post Type) with Self-Lubricating Bearing.



Dodge "Independence" Split Wood Pulley with Interchangeable Bushing.



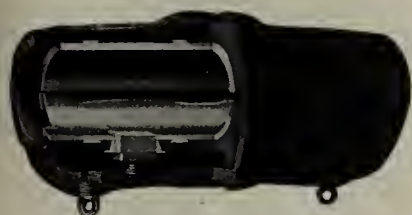
"Keystone" Steel Split Pulley.



Dodge "Standard" Split Pulley with Interchangeable Bushing.



Oneida Steel Split Pulley.



Dodge Self-Lubricating Bearing, Famous Capillary Type.

Cement Plants—where Transmission Machinery is put to the severest tests, where intermittent loads are the rule—are among the largest users of Dodge Transmission Equipment.

Every item in the Dodge line is designed and made for strenuous reliability. Every piece of Dodge machinery will give faithful economical service.

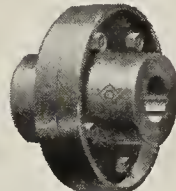
The Cement Plant that is Dodge equipped throughout enjoys the additional advantage of having its machinery built with proper regard to the correct inter-relation of every separate part. There are many such plants in this country.

Our Catalog of power transmission equipment is here for you.

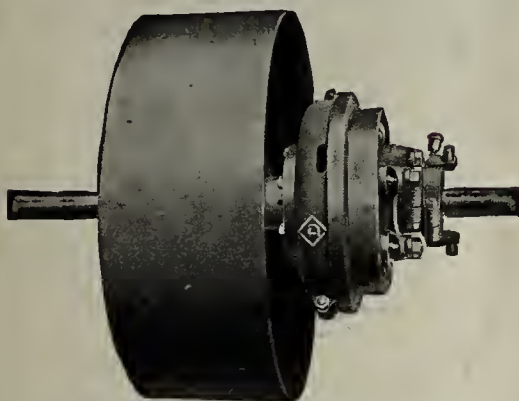
Always send your order through a regular Dodge dealer when possible—we prefer it that way.



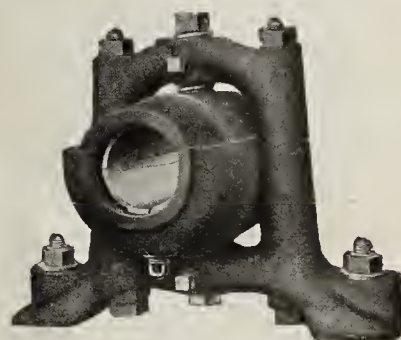
Dodge Keyless Compression Coupling.



Dodge Flange Coupling.



Dodge Split Friction Clutch as Used with Iron Pulley.



Dodge Adjustable Pillow Block with Self-Lubricating Bearing.

Dodge Sales and Engineering Company

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Concrete in Bridge Construction

Principle of Reinforced Construction Old—Economy
in Construction Demands Permanent
Structures

Natural cement was applied to bridge construction in the early part of the nineteenth century and masonry work was much improved by its use. The development of the Portland cement industry, most of which has taken place since 1855, provided a more reliable material; and, as a result, plain concrete has come into very extensive use, both for arch bridges and for the substructures of other forms of bridge construction. The introduction of Portland cement was responsible for the development of a new material of construction—reinforced concrete.

Principle of Reinforced Construction Old

The idea of increasing the tensile strength of mortar or concrete by embedding rods of metal or sticks of timber therein was not entirely new according to a statement made by J. A. L. Waddell in "Bridge Engineering." The Romans had used the former method to a limited extent in the construction of roofs of tombs, and the Chinese had employed the latter in building the great wall.

The advent of reinforced concrete has extended the development of beams and arches and has brought into common use the continuous girder and the hingeless arch.

Application of Concrete to Bridge Work

One of the most important applications of concrete to railroad construction is in the building of bridges. By the intelligent use of reinforced concrete, bridges are being designed which are superior to steel, masonry, or wooden structures, from an artistic, structural and economic standpoint.

Economy in Construction Demands Permanent Structures

Economy in railroad construction demands permanent structures. Materials must be used, therefore, which as far as possible, are proof against the deteriorating and destructive influences of the elements and of vibration, so as to resist corrosion, decay and fire, and the gradual weakening due to continual, severe and constantly growing service. At the same time the materials must possess requisite strength for present and future traffic combined with cheapness and frailty of construction.

While the life of a wooden bridge is about 10 or 12 years, and the life of a steel bridge probably not over 50 years, and then only with a continual outlay for repairs and painting in addition to careful inspection, a concrete bridge will last almost indefinitely and with practically no maintenance. In addition to its natural permanence, such a bridge is proof against tornadoes, high water and fire.

Steel and wooden bridges grow weaker from rust and decay, and in a few years the day comes when the bridge of decreasing strength is overloaded by the increasing weight of rolling stock and requires either strengthening or replacing. Concrete bridges on the other hand grow stronger with age and in probably as rapidly an increasing ratio as the increase of traffic.

General Comparisons

In the construction of a concrete bridge there is no obstruction of traffic from swinging booms, as in the case when setting stone of large dimensions in masonry bridges, nor so much difficulty in securing the necessary skilled labor during times when there is activity in the construction industry. The materials used can usually be obtained in the immediate vicinity of the bridge site.

The cost of a reinforced concrete bridge in almost all cases will be considerably less than of a stone masonry structure, and will not greatly, if at all, exceed that of a steel bridge when the cost of piers and abutments is included in the comparison. Even when the cost of steel is less, the difference is more than counteracted by the practically negligible maintenance cost of the concrete structure.

State Equalization Board Considering Classification of Raw Material

Whether cement deposits as they occur in the formation at the Baker, Utah, plant of the Ogden Portland Cement company are to be considered as a mine is being discussed before the state board of equalization by C. R. Hollingsworth of Ogden, representative of the cement company.

The matter came up in connection with a recent trip made by Prof. William Peterson, state geologist, to the plant at Baker. The materials there converted into cement consist of clay and marble, found in loose form, and capable of being extracted with a "clam-shell" steam shovel.

Professor Peterson holds that regardless of the manner in which these deposits occur, they must be considered as a "valuable mineral deposit" for assessment purposes by the board, and the board ruled with him. Whether the matter will be tested out in the courts has not been made known, but Mr. Hollingsworth took the position that the United States authorities had already decided that the deposits in question were not a mine. Professor Peterson says that they are identical in chemical nature with limestone and clay used at other cement plants, concerning which no question is raised as to their being mines.

In deciding that these beds—formerly supposed to have been under the waters of the receding Lake Bonneville of the geologists—are mineral, the board of equalization also decided that lands adjoining this property should be treated the same as agricultural lands carrying riparian rights.

Dunn Concrete Machinery

A valuable and attractive catalogue of concrete machinery and molds has recently been issued by the W. E. Dunn Manufacturing Company, 414 Twenty-fourth street, Holland Mich. The book contains 72 pages and many illustrations.

After an introductory section of eight pages, the Dunn cement drain tile machines are taken up. In these machines, the packer-head comes up from below, leaving the casing unobstructed for filling and giving extra packing to the bottoms of the tile, which must support the weight of the whole tile during curing. The No. 1 machine will make 2,000 tile per day, 12 inches long and from 3 to 12 inches in diameter. The Dunn "Automatic" drain tile machine makes from 3,000 to 3,600 tile per day, 12 inches long and from 3 to 16 inches in diameter.

Dunn concrete mixers are also described. These are of the cylindrical, open drum type, supported by a hollow cast yoke. They are made in two sizes, 5 and 3½ cubic feet to the batch. Other Dunn products are fence post molds, using the vibratory system, sewer pipe and tile molds, cement block and brick machines, concrete elevators and conveyors and many different pipes of ornamental molds.

The Improvement of a World Necessity

Do not overlook the opportunity
and profit it offers you.



Granite Faced Helm Brick

Helm pressed cement brick are faced with nature rock facings more beautiful than any clay faced brick on the market. These facings include granite, marble, feldspar, mica and other crystalline aggregates. Also with permanent mineral colors in reds, browns, buffs and other tints. The process is so simple expert labor is not required.

The manufacture of brick is as old as civilization—the demand for brick is as certain as day and night. Practically every building means a brick sale—the total brick business in your locality is large and profitable.

Make Helm brick and people will buy more brick from you than from anyone else—because Helm brick (plain or faced) is an improved brick. It is stronger, more durable, faster to lay and better looking.

There is not a better business opportunity open in your town than the manufacture of Helm brick, and we assure you that you can easily make it a success. It is simply a matter of your making the start.

**Helm Machines
for \$25 and Up.
Capacity to 15,000
Brick per
Day.**



FREE BOOK

Send Us That Coupon

It will not obligate you a penny's worth to let us show you the advantages of Helm brick and the large profits that are being made in its manufacture. Let us go into the matter with you very carefully.

**The Helm Brick Machine Co.
593 Mitchell St.
Cadillac, Mich.**

**Helm
Brick
Machine Co.,
593 Mitchell
Cadillac, Mich.**

Gentlemen:—Please send me full particulars about the Helm Brick and Block Press and the Products it makes.

Name.....

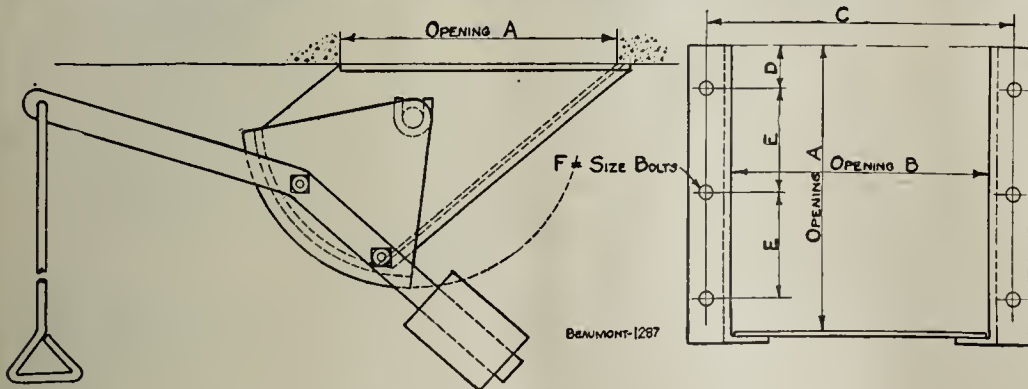
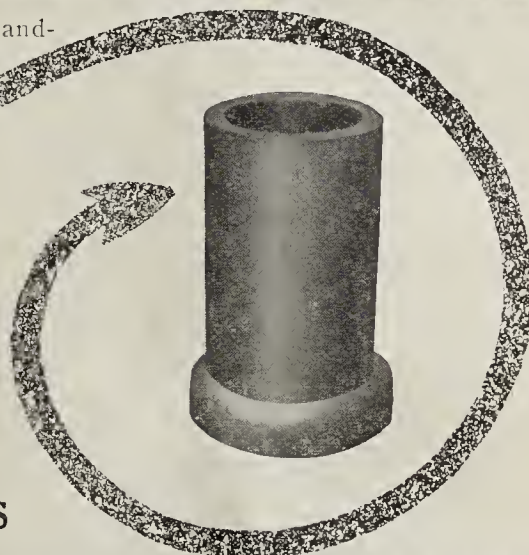
Address.....



Northwestern Steel Forms are accepted as standard in every state. Used and recommended by engineers and contractors in every part of the country for construction of culverts, sewers, flumes, drains, tile and similar work. They are durable, economical, satisfactory.

Tile and culverts can be made on the job. For complete information write for Bulletin No. 29.

**NORTHWESTERN
STEEL & IRON WORKS
EAU CLAIRE, WISCONSIN**



Lever Undercut Gate

An undercut gate should always be used for material containing large lumps, as an overcut gate will close down on a large lump and remain partly open, allowing the finer material to drain out. This gate is made for attaching to side of bins as well as to the bottom.

Other types of gates are shown in our Catalog 37. Write for it.

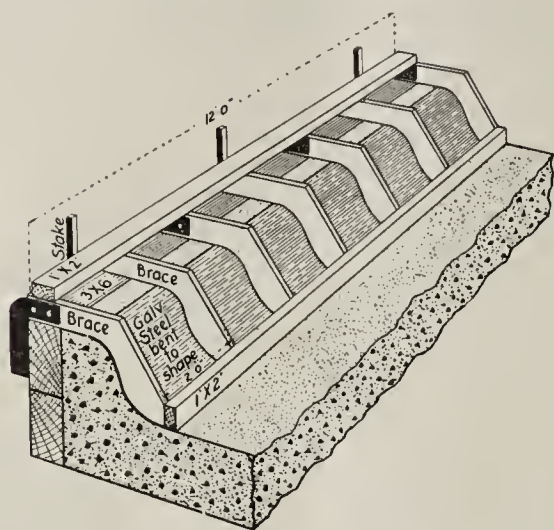
Beaumont Mfg. Co., 340 Arch St., Philadelphia, Pa.

Integral Curb Construction

The advantages of integral curb construction are becoming recognized by more engineers every day.

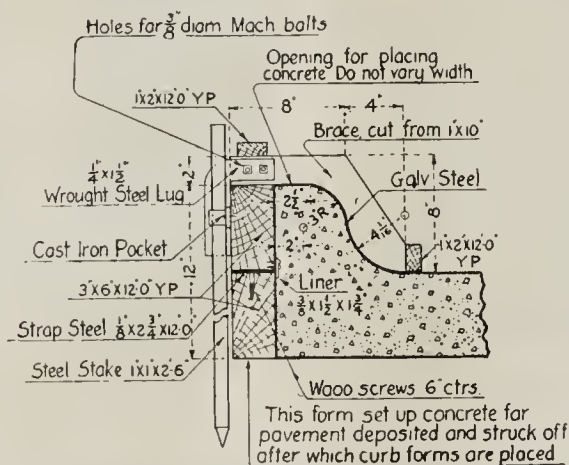
Forms for curbs should be made up of the design shown by the accompanying sketch. This form gives a curb which is ideal. It is of pleasing appearance and does not retain dirt.

In building this curb some contractors have placed their forms and filled them at the time of the placing of the concrete for the pavement proper. The difficulty with such a procedure is that the water removed by



rolling and with the belt finds its way to the gutter line and must be removed by brooming. However, even with the most painstaking efforts some laitance will remain along the gutter and will subsequently check, resulting in a rough flow line.

To avoid such a condition many contractors are following the plan of placing and finishing with the roller and first belt the pavement proper, then placing their curb forms and constructing the curb. This is the method that is recommended, because of the facility in finishing, in removing the excess water, and in avoiding any laitance effect.



In order that this procedure can be followed, it is necessary that the retaining form for the curb be built up in two sections as shown on the drawing. The first section serves the purpose as a side form and permits the roller and belt to be operated over it. After the first belting, the second section of this form is placed and the integral curb mold put in position.

The only objectionable feature to such a method is that it necessitates wheeling sufficient concrete for the curbs from the mixer to where the curb forms are in place, but this additional cost is offset by the increased speed and facility which can be attained on curb finishing work.

The Burial Vault Business

There's no joke about this business. It's sane, solid and sensible. You needn't be ashamed to go into it. You can get business men to back you, because from the very nature of the article a demand for it is increasing right along with the increase in population, writes the Automatic Sealing Vault Co., 216 East River street, Peru, Ind.

You can operate this business in connection with a block, brick, tile or post plant, or you can operate it independently. The extent of the vault end of your business depends entirely upon your own enterprise.

Some men first get the idea that you have to peddle vaults at funerals, which naturally stops them from further investigation, but this isn't the right idea at all. You simply work through the undertaker by furnishing him a price that he can sell it for and still enable you both to make a good profit. Concrete is the ideal vault material—but all concrete vaults without our patented seal are not a success.

This much is certain—and a man with very little capital and average common sense and a bit of business energy can start making vaults on a small scale and sell them and make more and sell more until he has a big, well-established money-making business worked up.

But—he must start right—He must be able to make good vaults, at low factory cost—vaults that undertakers would push—vaults that people will demand.

Our molds are simple, designed so they are adjustable to make 7 standard sizes of vaults, and when the concrete is poured into this mold and has set sufficiently, the molds can be removed, which leaves a smooth surface without the mark of a rivet head showing up.

We sell you the molds outright—no blue sky. You buy the molds at a fair price and they belong to you. But we don't stop there—we help you get started—help you turn out first-class vaults—show you the knacks and methods to get the undertaker lined up.

We'd like to hear from the right kind of men now—the investment required is small, the returns large.

Our big book explains all. Write for a copy.

Jeffrey Standardized Elevators

The Jeffrey Manufacturing Co.'s catalogue No. 244 recently completed, displays the advantages of the standardized elevators made at the works of this company, Columbus, O., and it also has other important data. The book contains 40 pages devoted to details of elevators selected from numerous styles used for handling a wide range of materials in practically every industry. A page is given to each of these standard elevators, which is illustrated both in perspective and in line drawing with dimensions. There is also another picture showing the chain and the bucket used in that type of machine, while at the foot of the sheet is a complete list of its specifications. These numerous examples will enable prospective purchasers to readily select elevators suitable for their requirements; thus saving time and the expense of making layouts and drawings. The manufacturing system is said to be such as to insure quick delivery.

Convention American Concrete Institute

Henry B. Alvord, 6 Beacon street, Boston, Mass., Secretary, American Concrete Institute, writes that at a recent meeting of the Board of Direction of the Institute the following dates for the next convention were determined:

June 27-28, 1919, at Hotel Traymore, Atlantic City.

SYNSTONE PRODUCTS

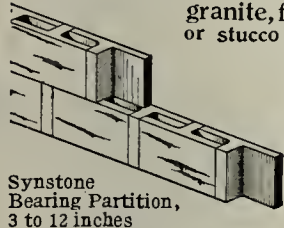


This SYNSTONE SINGLE WALL is being used for rebuilding Halifax.

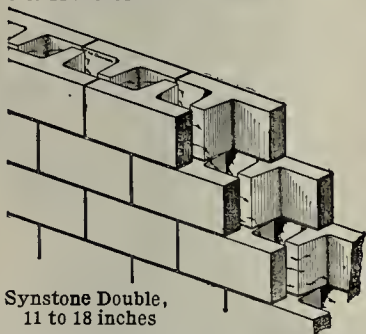
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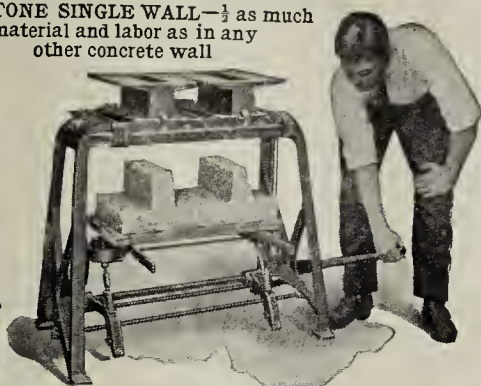


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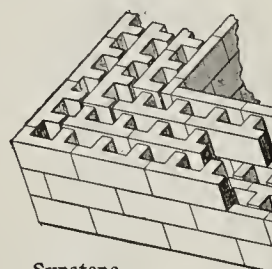
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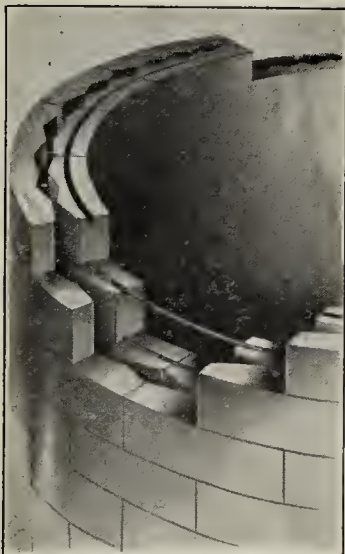


Synstone Brick Veneer Wall, 13 to 17 inches

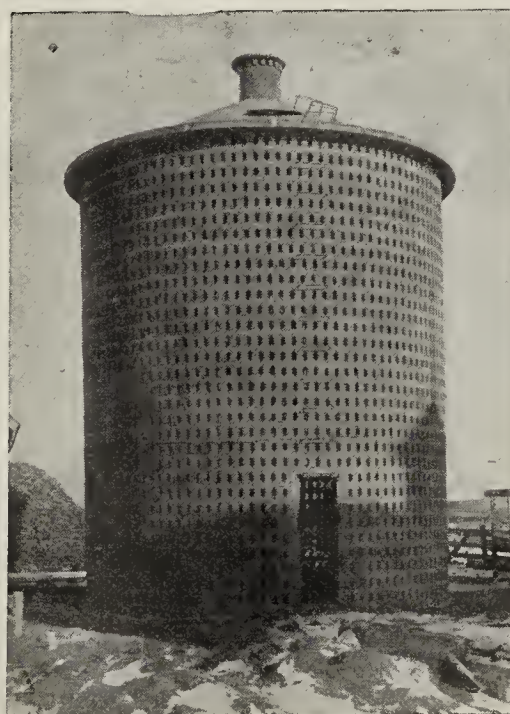
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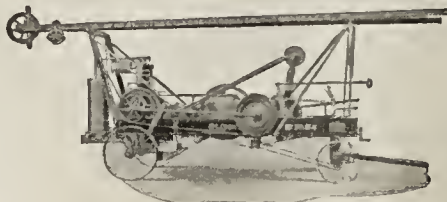
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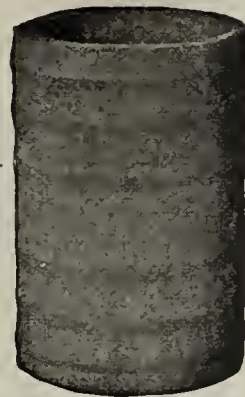
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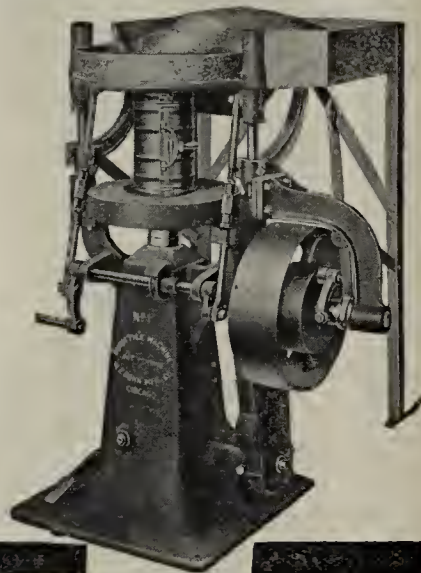
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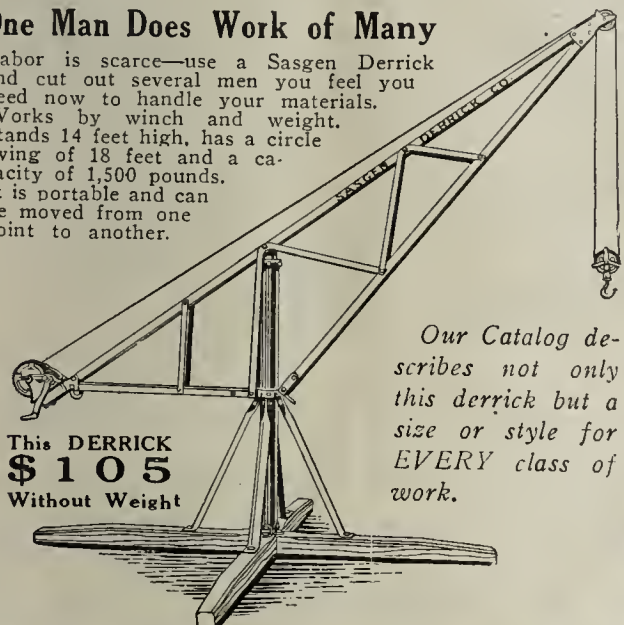
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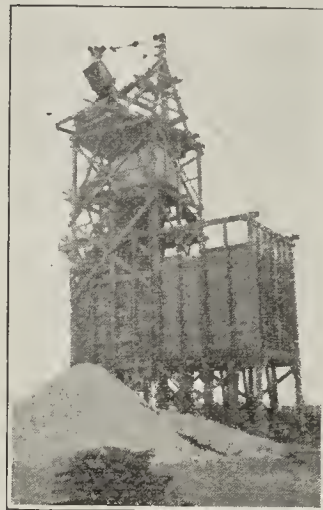
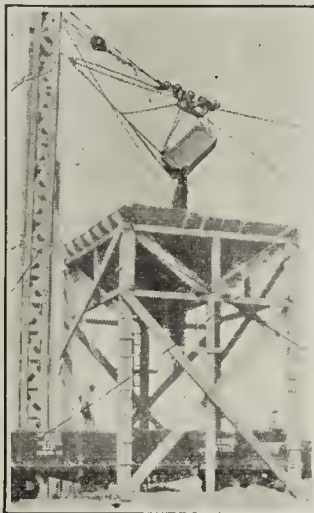


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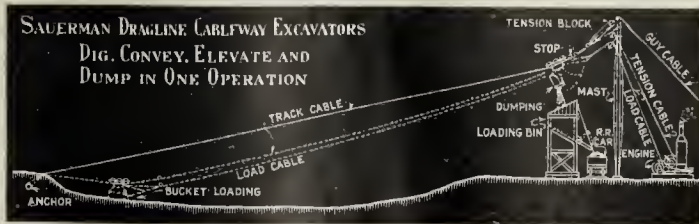
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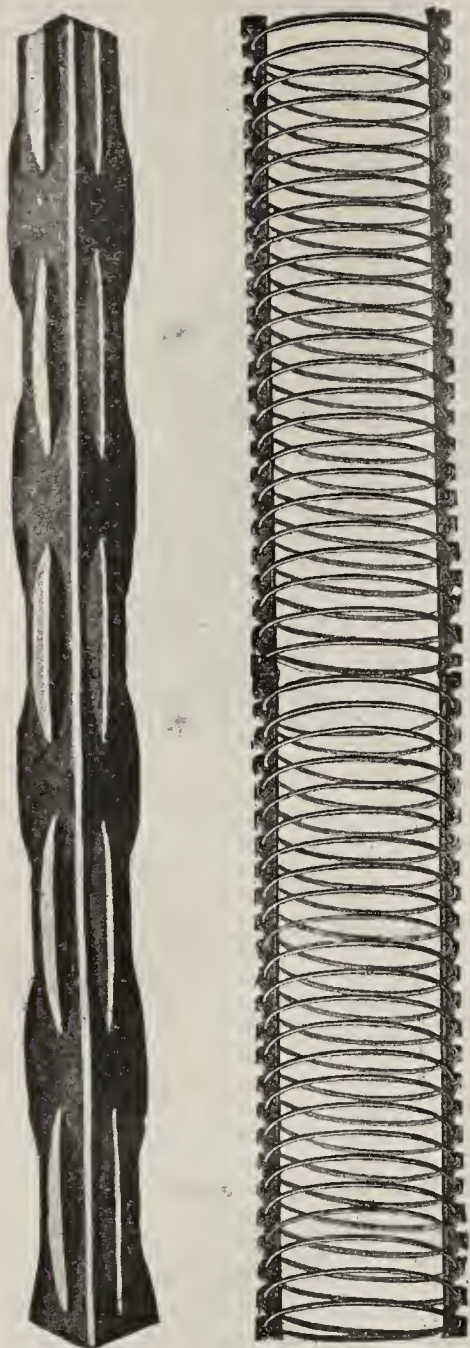
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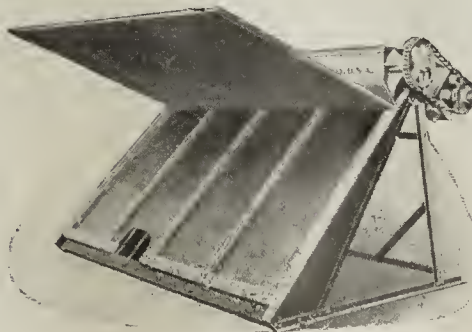
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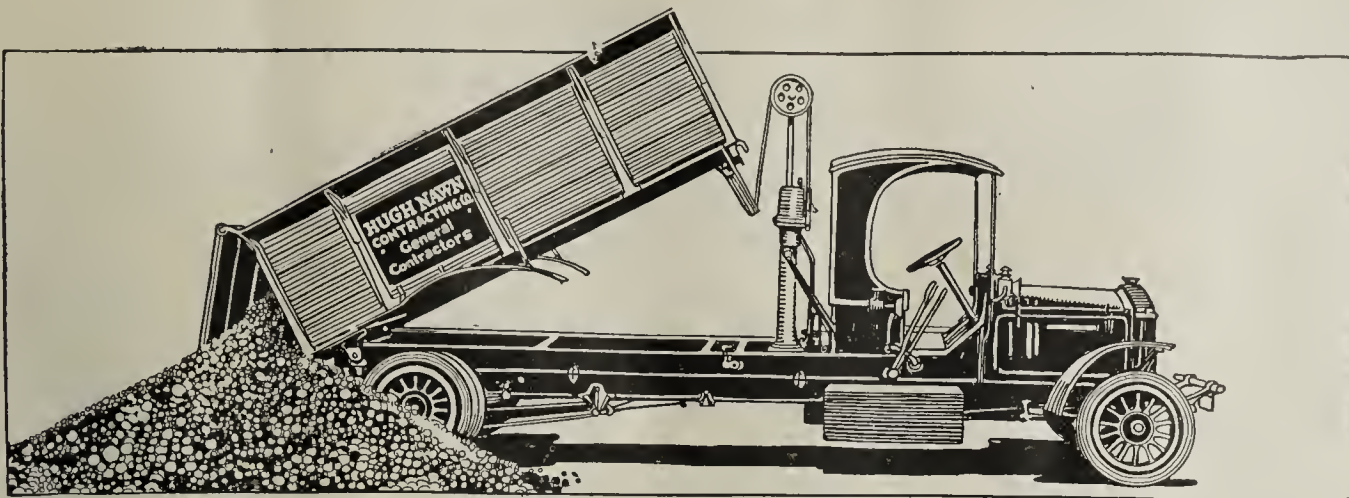
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COMPETITIVE TRUCK'S RECORD

Miles Run	13,095
Tonnage hauled	10,768
Gallons of gasoline consumed	4,521
Pints of oil consumed	1,176
Repairs to motor	\$740.37
Labor repair cost	249.25
Tire cost	888.79
Year's operating cost excluding insurance, depreciation etc.	3,520.27
Average operating cost per day including overhead	19.80

PIERCE-ARROW TRUCK'S RECORD

15,517 Miles Run	
11,013 Tonnage hauled	
4,389 Gallons gasoline consumed	
385 Pints of oil consumed	
\$136.16 Repairs to motor	
152.91 Labor repair cost	
841.78 Tire cost	
Year's operating cost excluding insurance, depreciation etc.	2,768.96
Average operating cost per day including overhead	16.78

A number of other interesting installations are shown in our booklet, "What Pierce-Arrow Motor Trucks Are Doing In The Contracting Business." We shall be glad to send you a copy.

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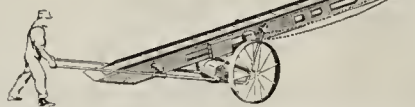
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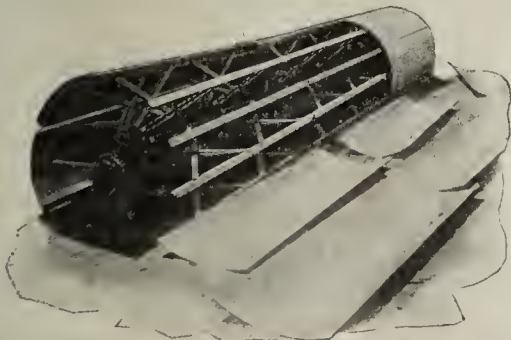
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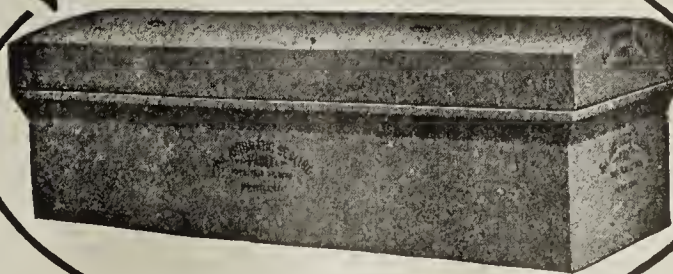
Automatic Sealing Vaults assure big profits and steady work.

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FOR WATER PROOFING AND TO FACILITATE POURING CONCRETE



In these 51 concrete storage tanks, recently erected in Cedar Rapids, Iowa, by the Quaker Oats Co., there are approximately 12,500 cubic yards of concrete—1-2-4 mix. The walls are perfect cylinders, with no lips or bulged surfaces.

Hydrated lime was used for waterproofing and also to facilitate pouring the concrete and lifting the forms, owing to its lubricating properties. In mixing, 25 pounds of hydrated lime was put into each batch, which made the percentage of lime to cement a little over 8% by weight. The mixers used were of such size that three bags of cement could be used in each batch.

Considerable credit is given by the Leonard Construction Co. of Chicago to the lime. The statement is made that the lime gave the exterior surface a white and uniform appearance, and that the surface needed no subsequent coating. There were no joints where the concrete stuck to the forms and "lifted," as it does in many cases where the concrete is not of uniform mixture.

Write any of the following competing manufacturers of Hydrated Lime for complete information about Hydrated Lime in Concrete

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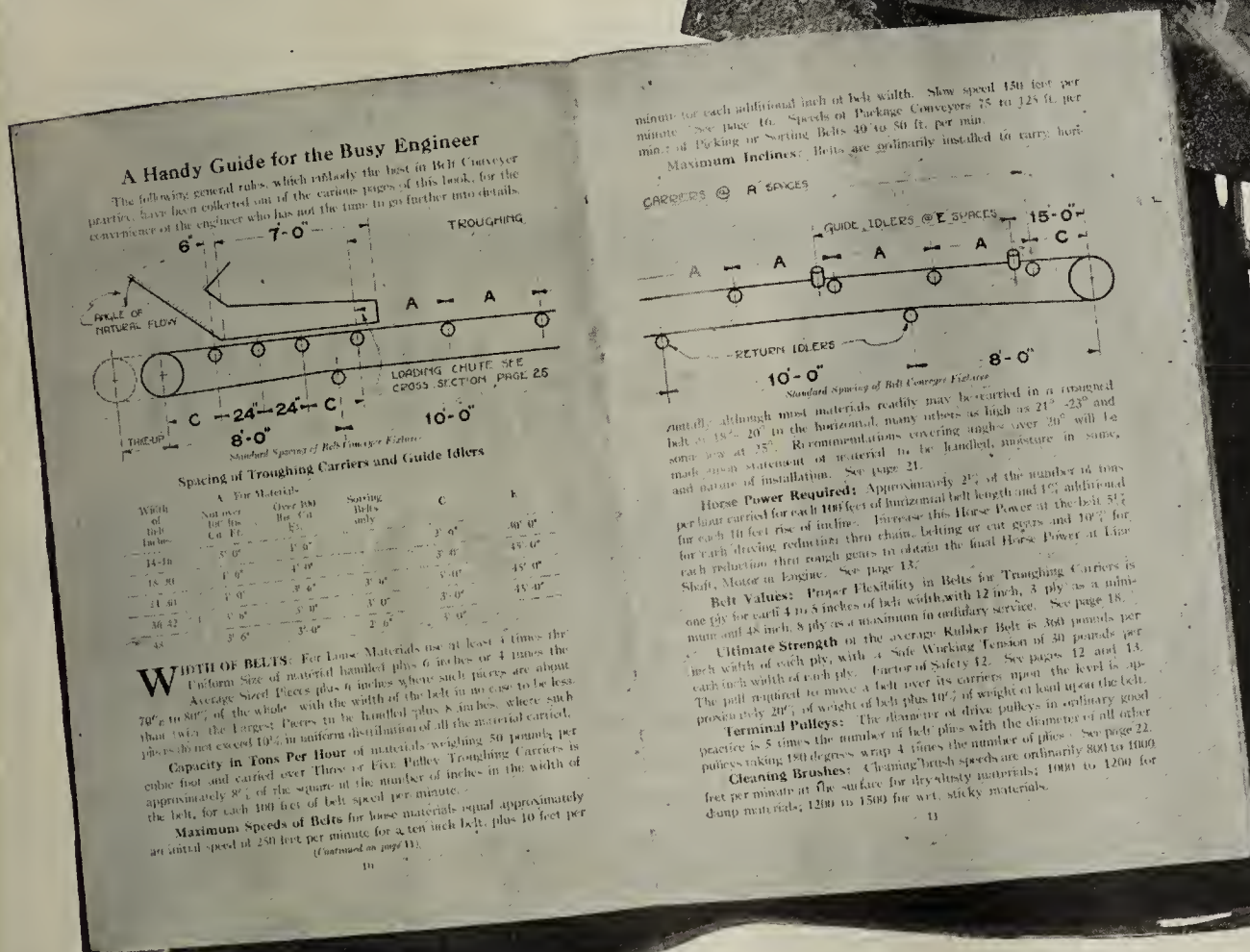
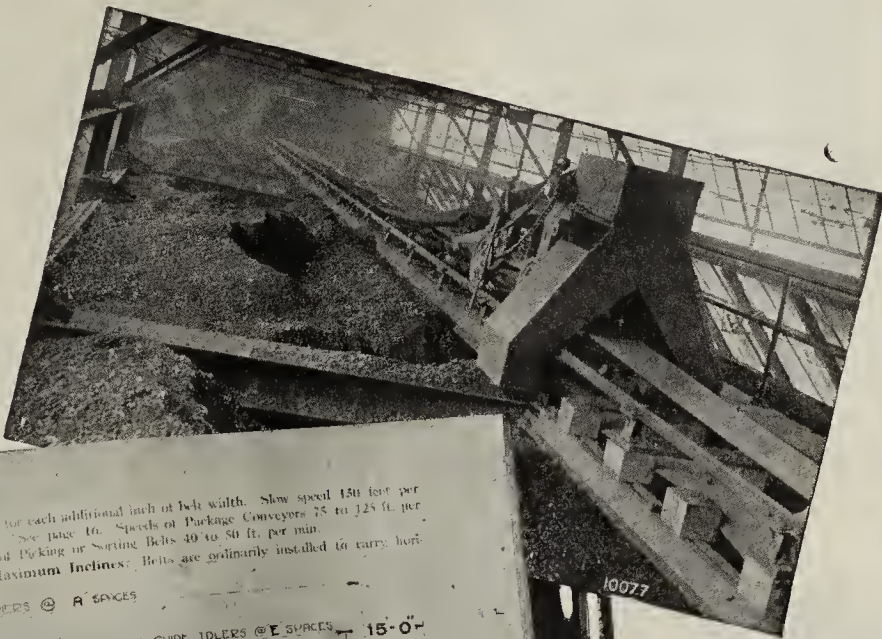
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Write TODAY for your copy
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Handle it Mechanically

CEMENT AND ENGINEERING NEWS

with which Gravel & Stone Magazine is incorporated

22 Quincy Street, Chicago.

(PUBLISHED MONTHLY)

William Seafert, *Publisher and Editor*

J. F. Waldron, *Advertising Manager*

R. M. McCully, *Business Manager*

Telephone, Harrison 5397

Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, \$1.00 per year; all
other countries, \$1.50 per year.
Single Copies 20c.

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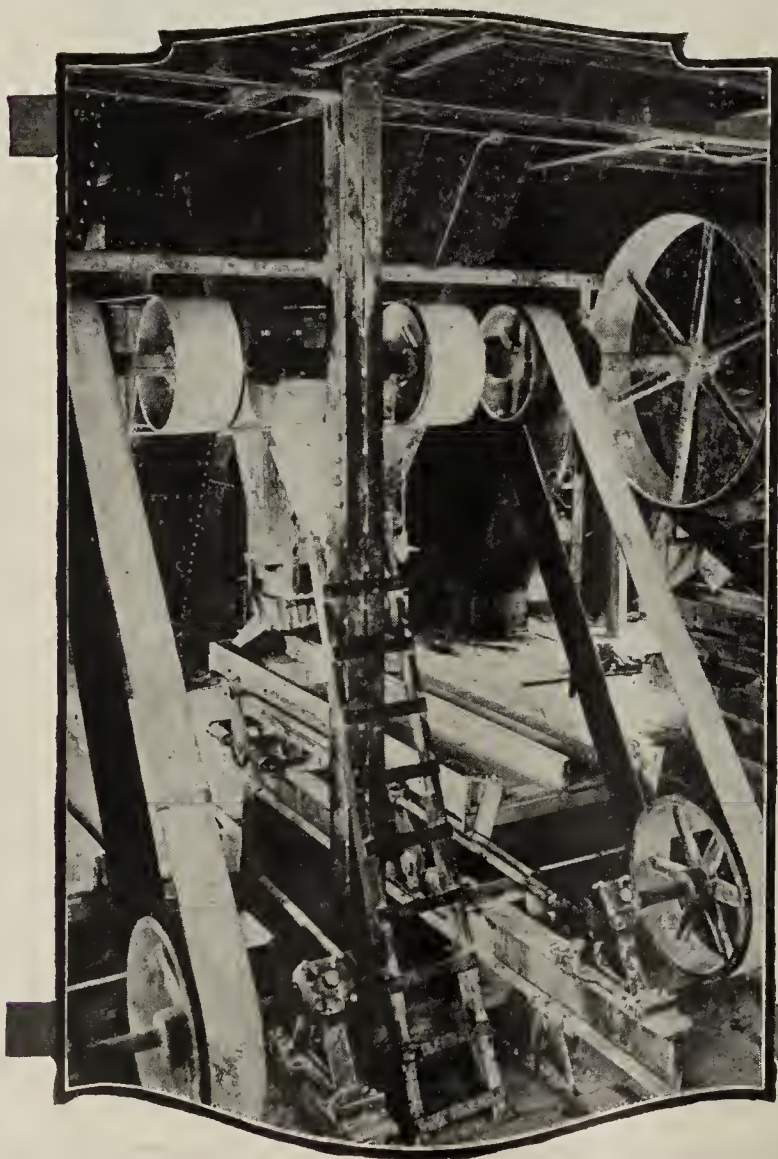
Vol. 31

CHICAGO, JULY, 1919

No. 7

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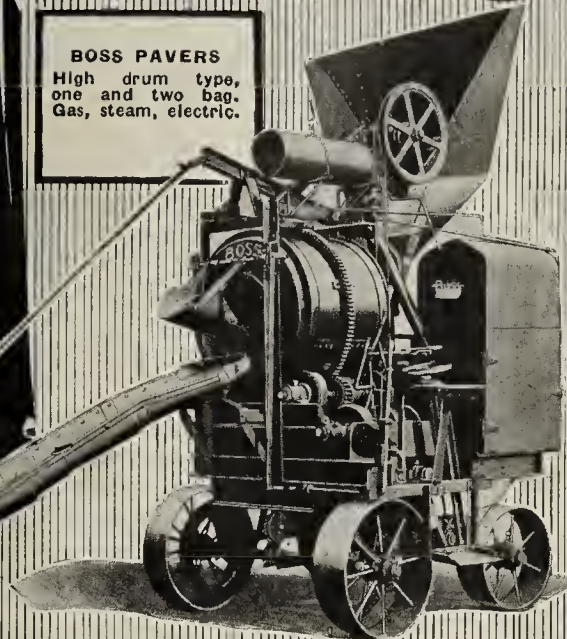
19 machines

16 machines

18 machines

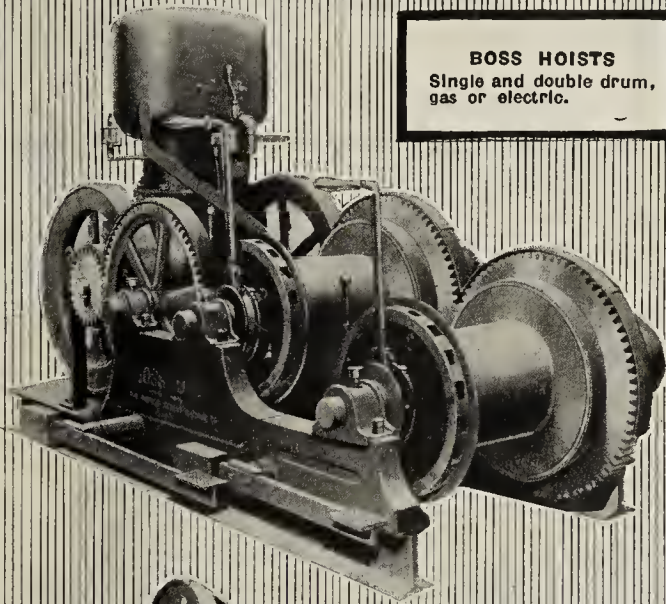
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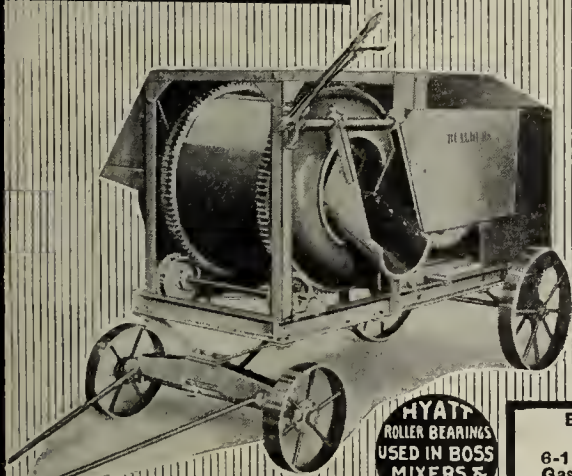
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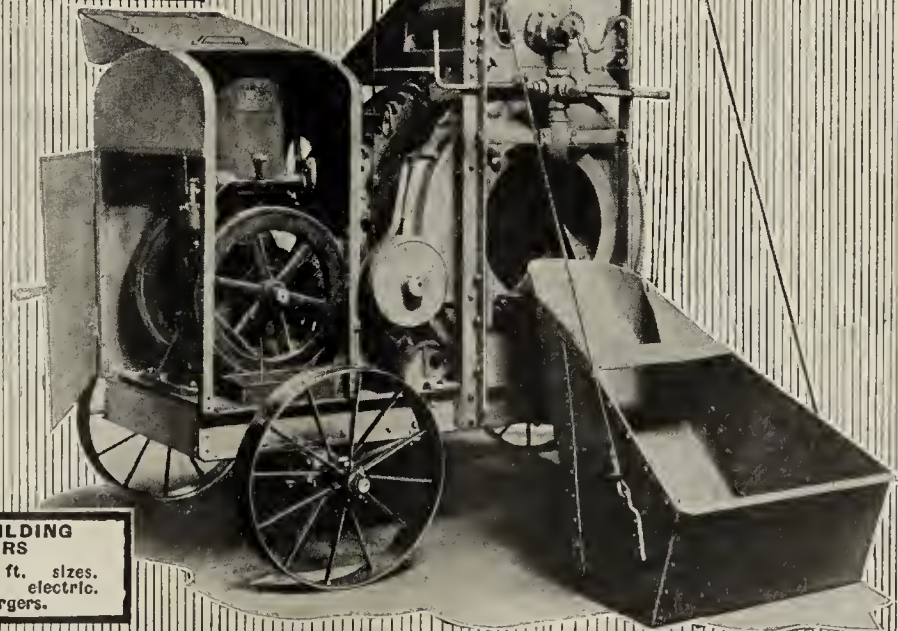
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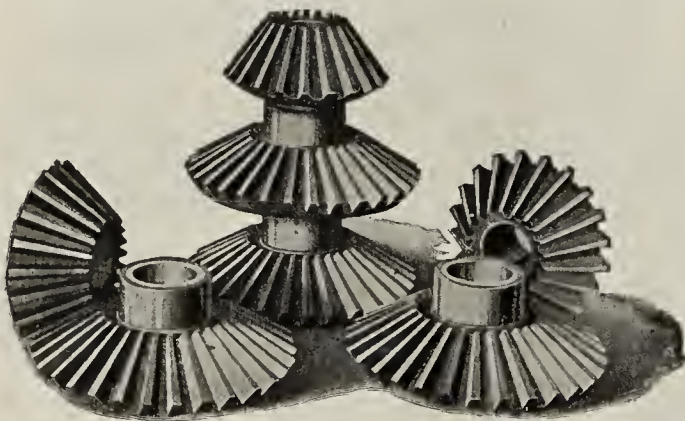
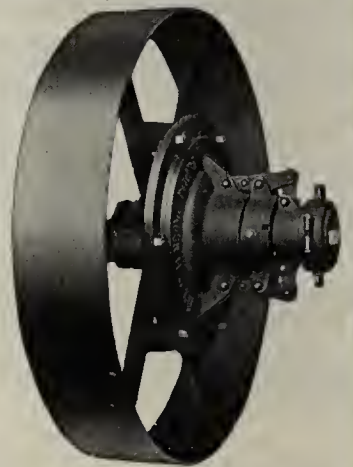
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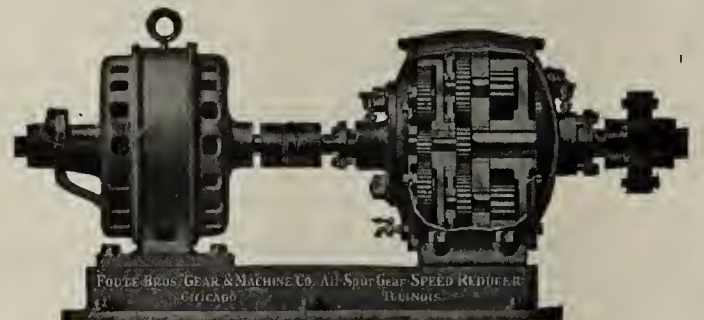
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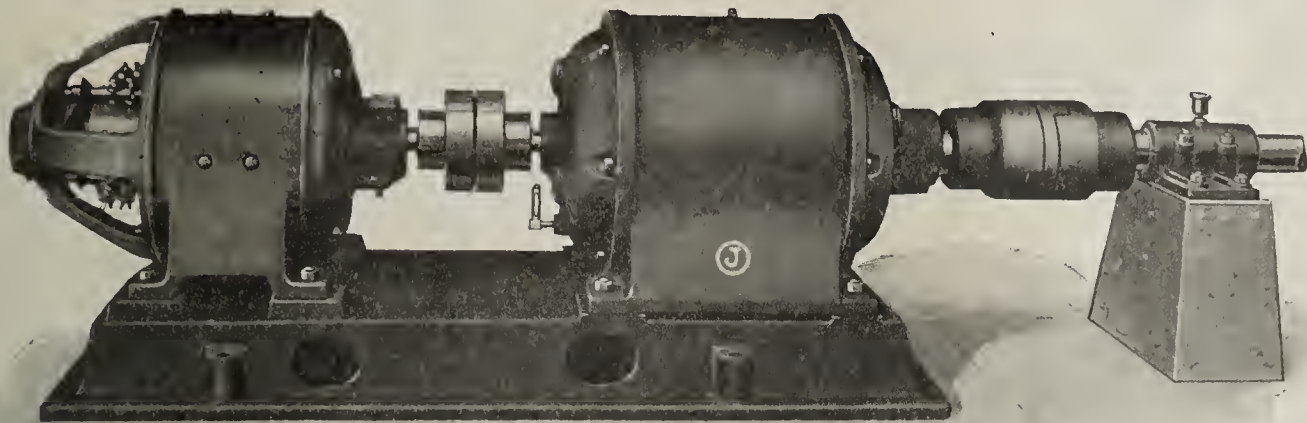
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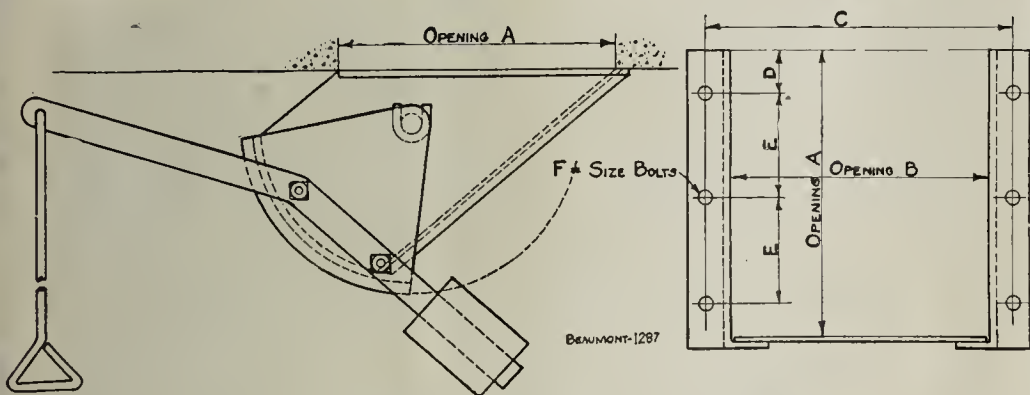
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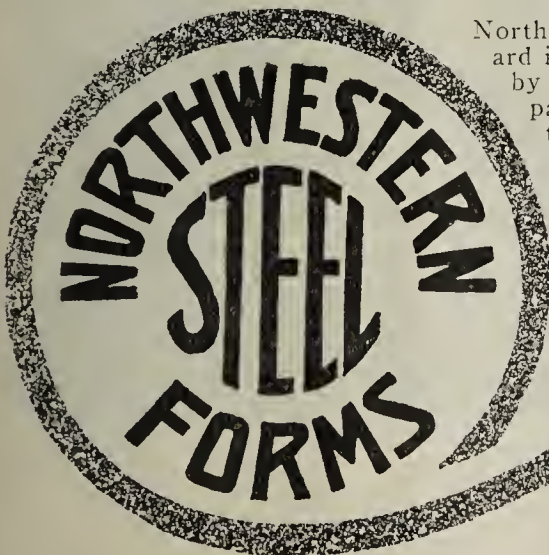


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An undercut gate should always be used for material containing large lumps, as an overcut gate will close down on a large lump and remain partly open, allowing the finer material to drain out. This gate is made for attaching to side of bins as well as to the bottom.

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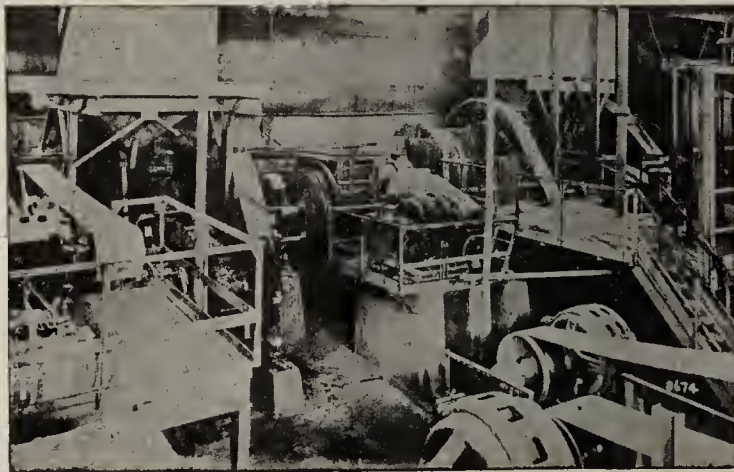
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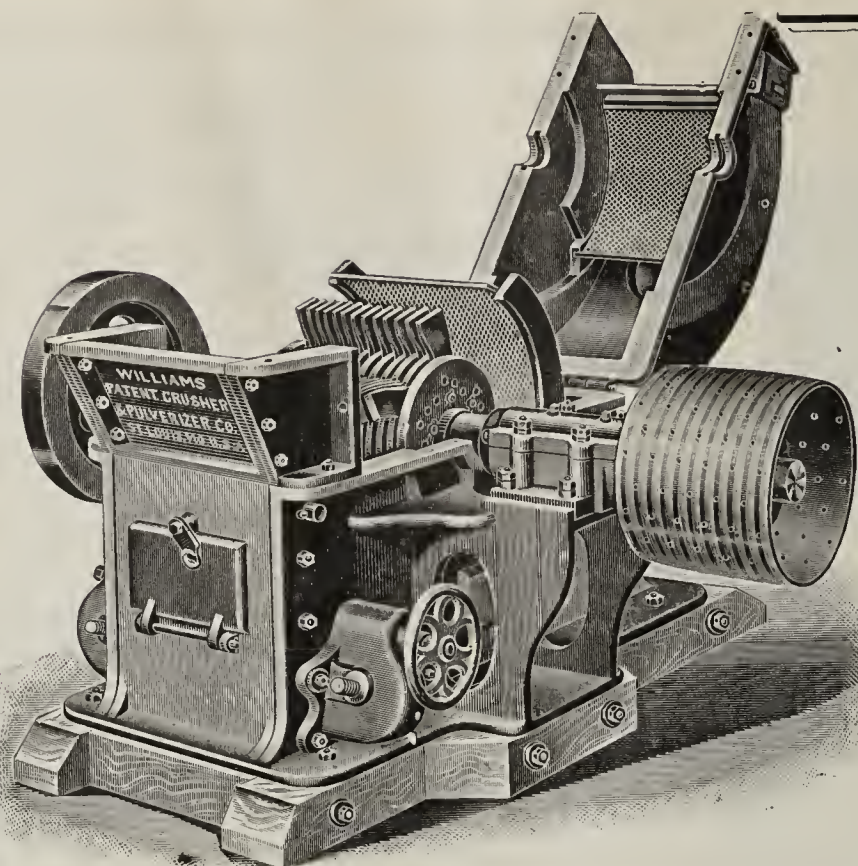
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CAPACITIES RANGE FROM 1/4 TO 30 TONS PER HOUR

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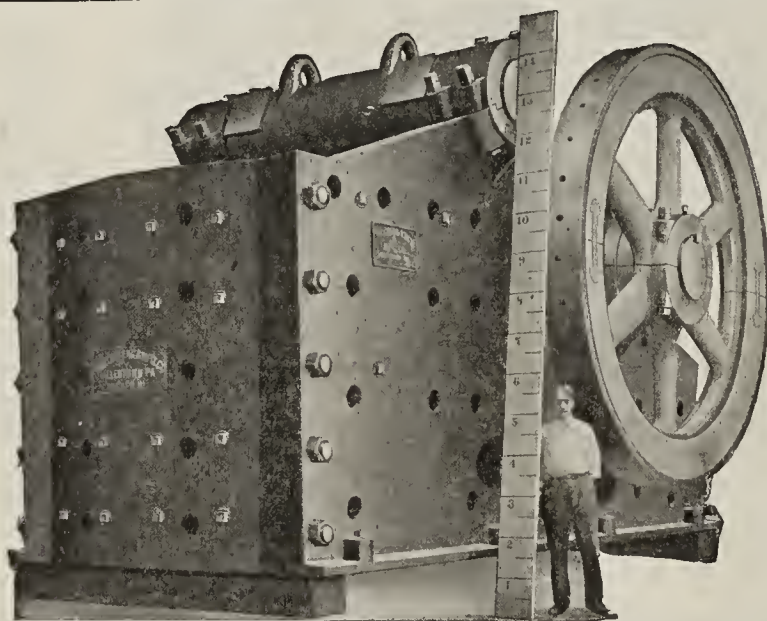
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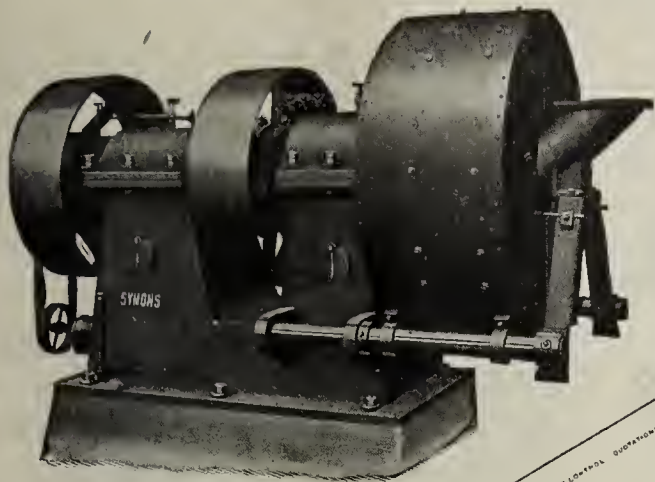
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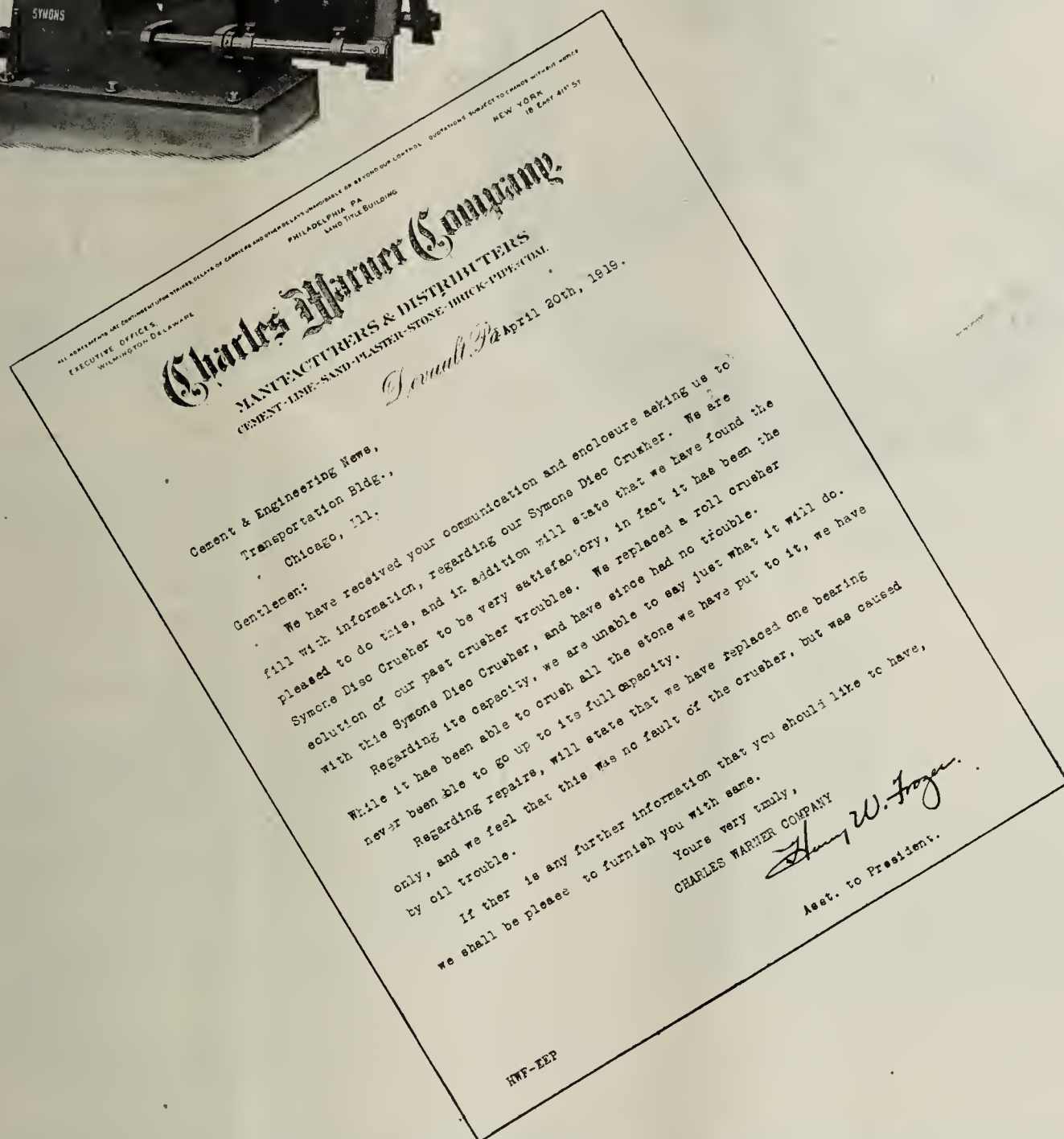
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FOR CRUSHING HARD ROCK, GRAVEL, LIMESTONE AND OBTAINING A UNIFORM PRODUCT, GET A SYMONS DISC CRUSHER IN PREFERENCE TO A SMALLER JAW OR GYRATORY CRUSHER OR LARGE ROLLS, CAPACITY 60% GREATER, REPAIRS 60% LESS.

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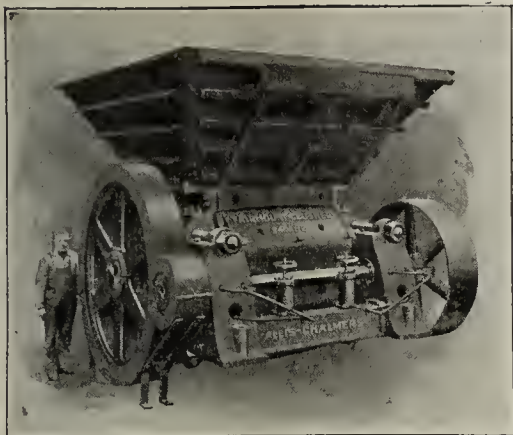
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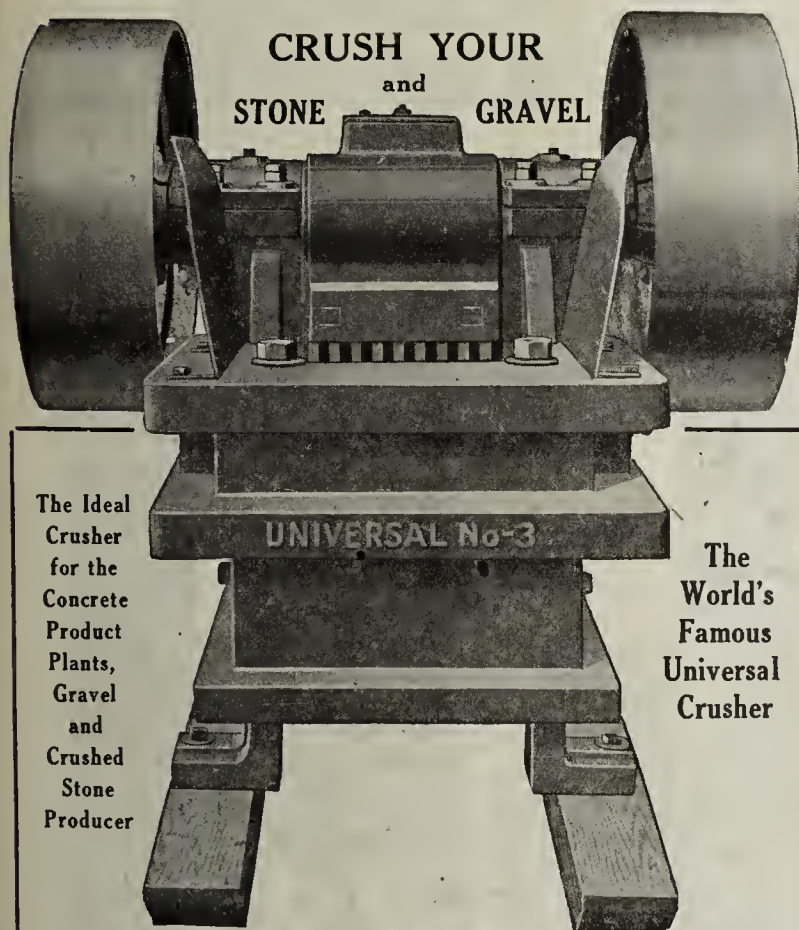
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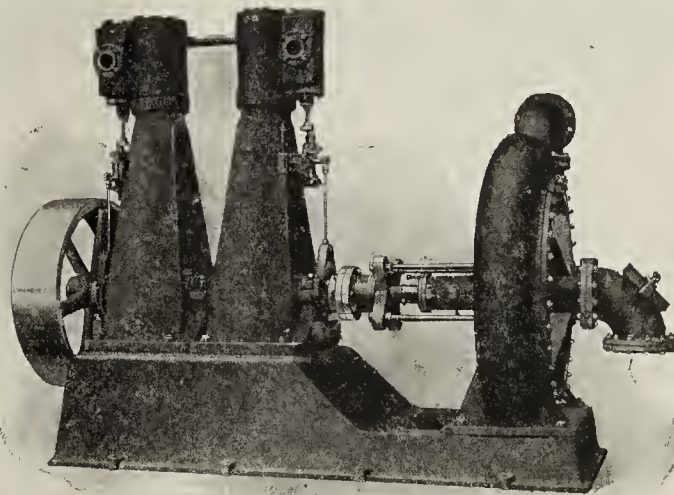
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Crusher
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Concrete
Product
Plants,
Gravel
and
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Stone
Producer

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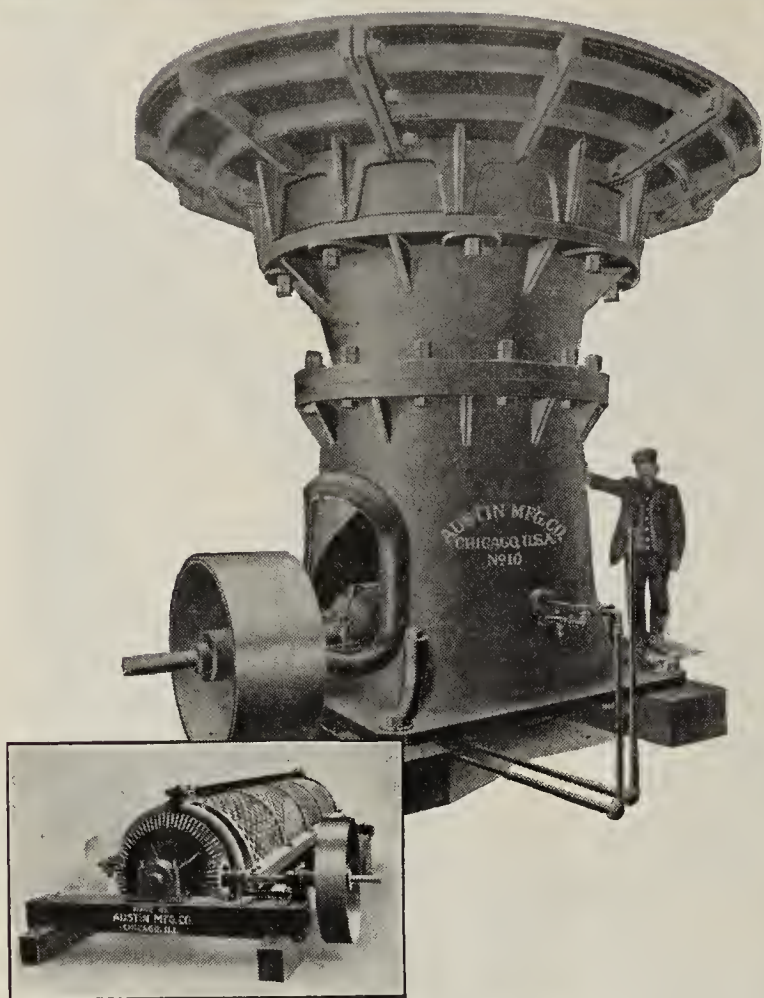
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lowest first cost as well as the minimum operating cost use

Erie Sand-Gravel Pumps

Small sizes as well as largest ones are designed
to give maximum output and greatest wear for a
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Catalog C30 gives complete information
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MEDINA, N. Y.



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*Reconstruction abroad means more
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More than ever before, American contractors, builders and quarry-operators are in need of rock crushing and rock-handling equipment that can be depended upon to deliver larger outputs and that will work steadily and efficiently without interruptions and breakdowns.

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paper pulp
beet sugar**

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for burning lime from the
spawl and unusable marble.

Plant of
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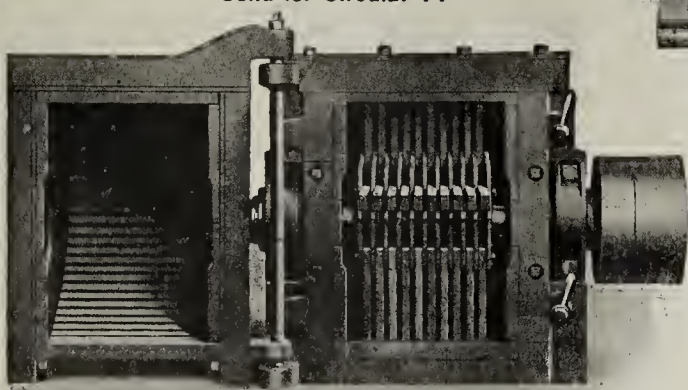


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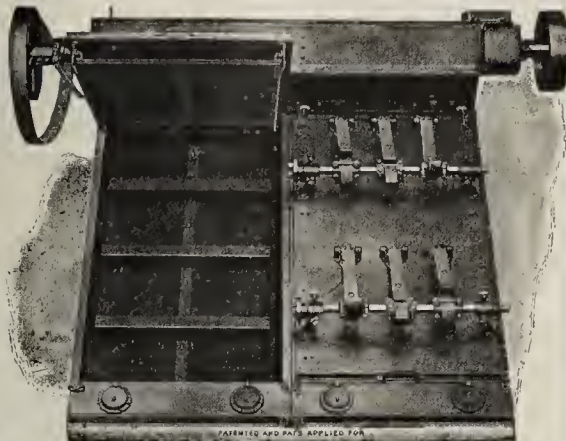
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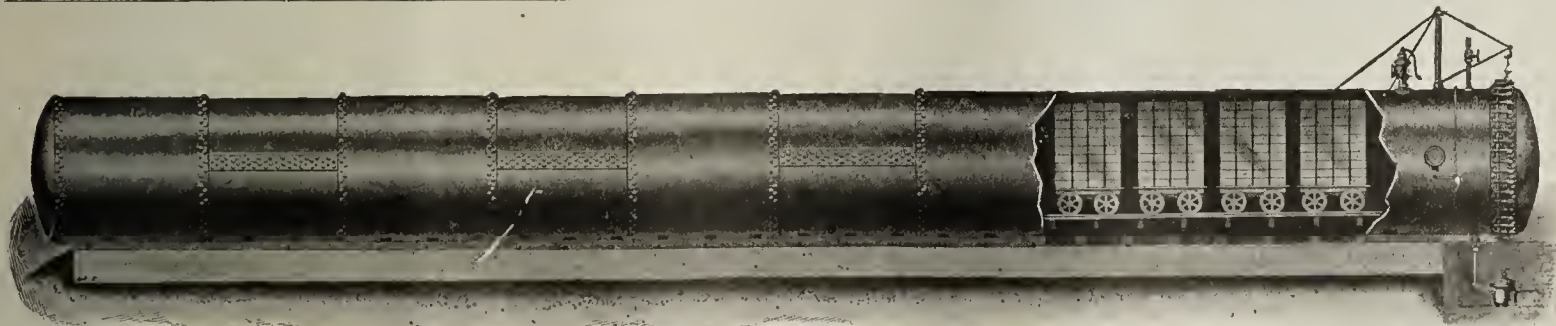
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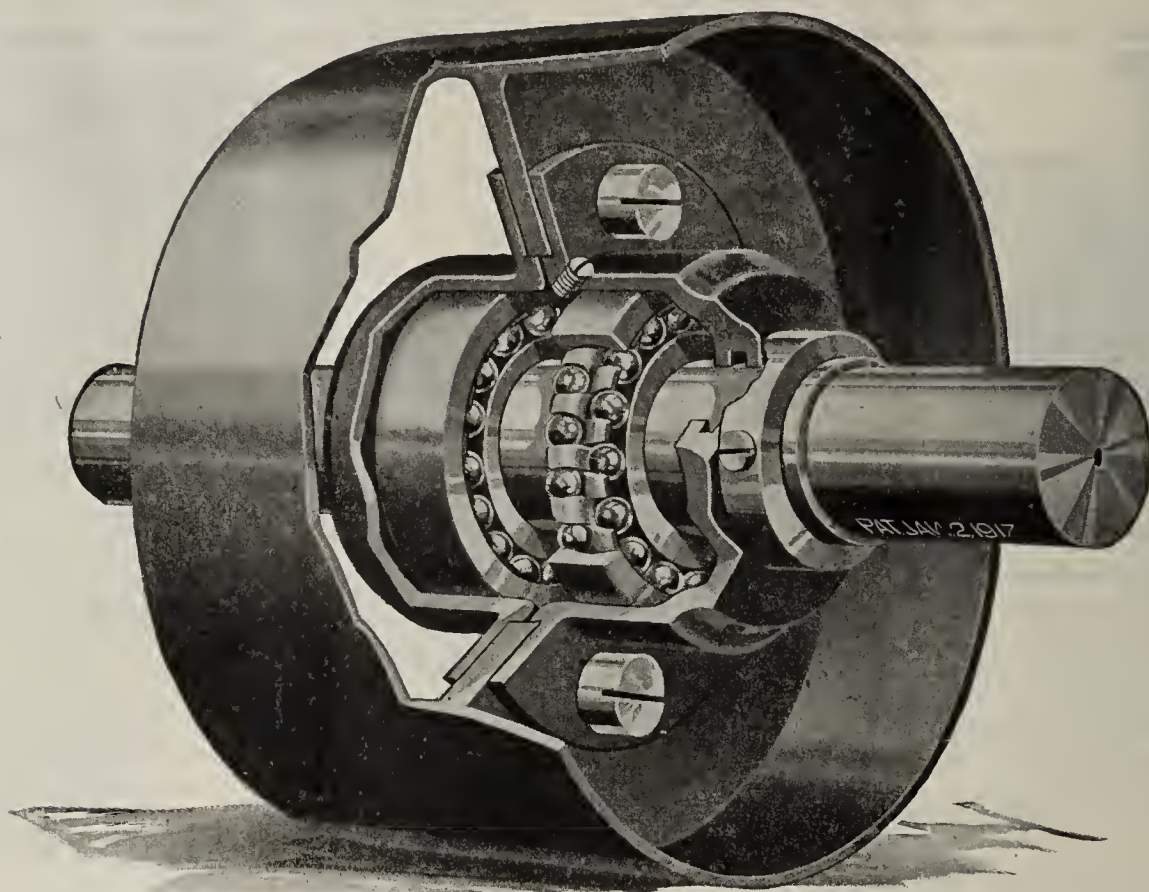
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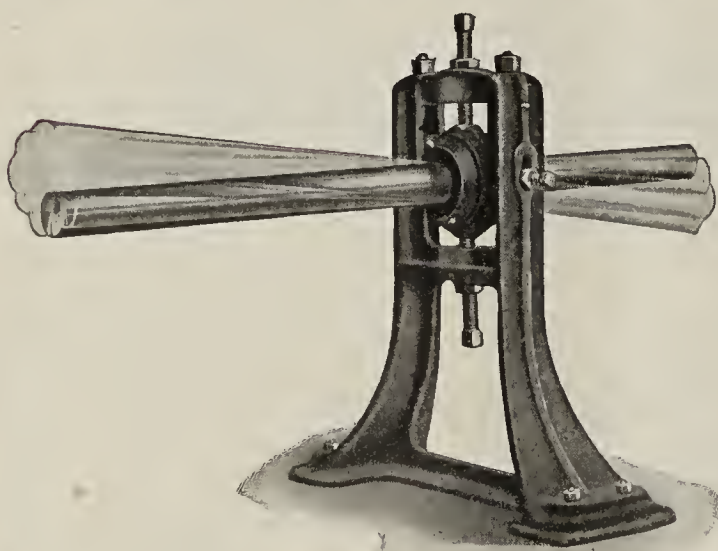


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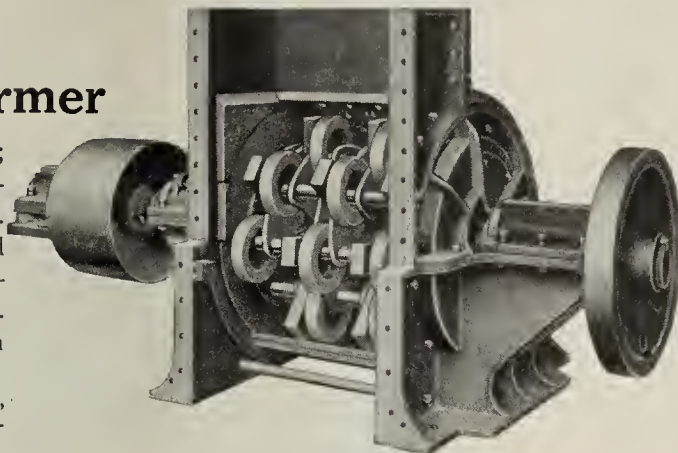
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are earning enormous profits for their users. The plant here shown paid five times its cost in profits in five months running. This is not an isolated instance. Many others have done equally well or better in producing

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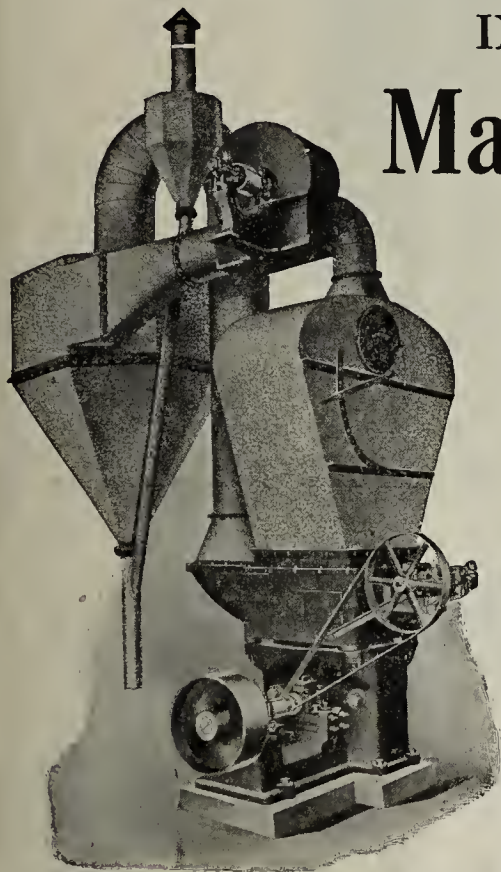
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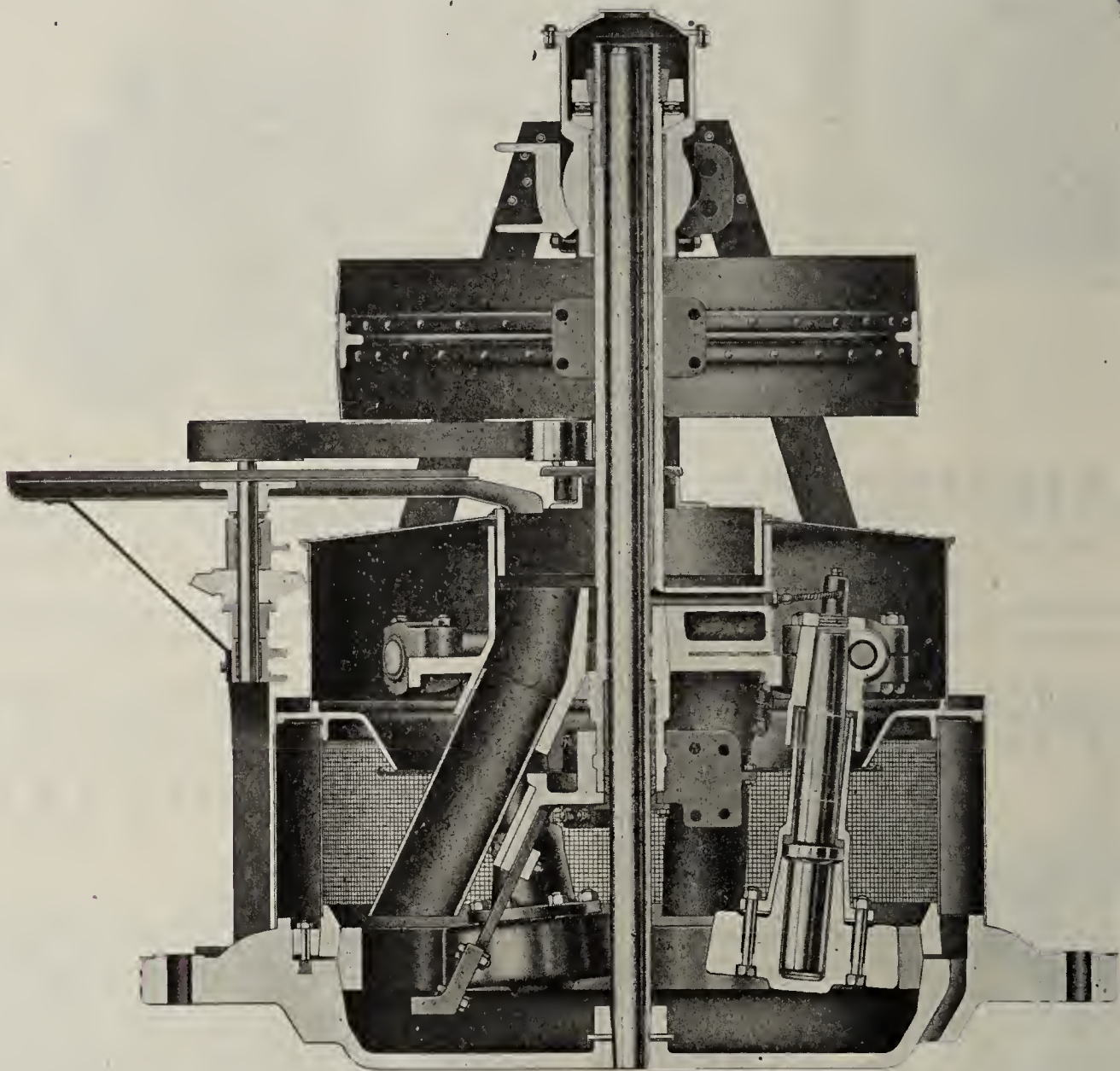
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Boston

Works: Allentown, Pa.

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Cement and Engineering News

Vol. 31

Chicago, July, 1919

No. 7



Cement plastered houses are not only fresh and clean to look upon, but they have a substantial appearance that is always most pleasing. There is nothing about cement that is difficult to understand, and mechanics who build cement houses are now so familiar with all the requirements of a good job that there is no difficulty in securing workmanship of the highest grade.

Good Roads Situation is Like Railroad Problem Fifty Years Ago

Lower Cost of Motor Transportation Means Lower Cost of Living, Says Motor Truck Manufacturer.

"Along with the great national movement for better highways comes the question of weight of loads, speed, and many other factors," says R. E. Fulton, vice president of the International Motor Company.

"In the solution of the matter, plain, ordinary common-sense should prevail. Unimproved roads, in good weather when they are dry and sound, can stand a great deal of traffic with little or no damage. They can even bear tremendous loads if the width of the tire is sufficient. When these roads are solid, big steam traction engines, with thrashing machines or corn shellers, run over them with no damage; in fact, with benefit as they act like rollers.

"Moderately improved roads likewise can stand much traffic in good weather. The big trouble with these roads is that they are not what can be called all year 'round roads. They should be improved to meet the normal requirements of traffic, so that full benefit may be derived from them at all times.

Large Loads Lower Prices

"The weight of the load should be determined on the basis of width of tires. Routes between large cities or important commercial and industrial centers serve an enormous tonnage, and the larger the units in which this tonnage is hauled the greater the economy of hauling. These routes are main arteries of traffic, and anything which increases the cost of transportation on them is paid for by all the people, regardless of how far they may be from these main arteries. When it is taken into consideration that a 50 per cent increase in the size of the unit hauled makes a 15 per cent decrease in the cost of transportation, the matter becomes one of great economic importance with tonnage running up into the millions.

Likens Roads to Railroads

"On these roads the weight is fully taken care of by the 800-pound limit per inch width of tire. For every 800 pounds, an inch is added to the bearing surface of the tires. With the addition of a trailer the weight of the load can be doubled without doubling the strain on the road. You simply add to the wheel base. The load, while greater, is distributed over more wheels of proportionate tire width. A striking illustration of this is given by our roads. While heavy rolling stock, such as the big compound engines which are now used on our railroads, are very much heavier than the rolling stock of years ago, the weight per inch of bearing surface has not been greatly increased. This has been met by putting extra bearing surface under the weight. For instance, the big engines now have 16 driving wheels, whereas the early engines had only four.

"It would have been as sensible fifty years ago to have prohibited the use of locomotives larger than the little 4-wheel drivers, as it would be today to limit the weight of the motor truck on any other basis than tire width, and the number of wheels under the weight, which in the case of our large locomotives gives several hundred per cent greater hauling capacity with probably only 100 per cent greater weight of rail. Without the development of the large locomotives and

the increased size of railroad cars, freight rates would probably be double what they are now. If we set an artificial limit on motor trucks, we are handicapping what is fast becoming an important means of transportation, and adding to the cost of every article of food or clothing we use, and placing a generally greater economic burden on the country. We must build the road to carry the load."

Concrete Tanks for Fuel Oil Storage

The proper construction of concrete tanks for the storage of fuel oil along lines that will reduce as much as possible the fire hazard, has been the subject of consideration of the Committee on Inflammable Liquids of the National Fire Protection Association. The committee now submits the following tentative regulations for the consideration of its members:

"Setting of Tanks.—(a) Tanks, if underground, shall be buried, so that the top of the tank will be not less than three feet below the surface of the ground and below the level of any piping to which the tanks may be connected.

"(b) Tanks shall be set on a firm foundation.

"(c) All tanks shall be provided with a concrete or other non-combustible roof.

"Material and Construction of Tanks.—(a) Reinforcement.—Sufficient steel reinforcement shall be used to resist the oil pressure, and the horizontal and vertical reinforcement shall be proportioned properly and located to reduce the shrinkage cracks, so that they will be too minute to permit leakage. The fibre stress in the steel shall not exceed 10,000 pounds per square inch. [Note—A fibre stress of 10,000 pounds per square inch should prevent shrinkage cracks, although a number of tanks have been designed with a fibre stress of 6,000 to 8,000 pounds.]

"(b) Concrete.—The concrete for floor and walls shall be at least 8 inches thick, mixed in the proportion of 1:2:3; or, better, 1:1½:3, and having the coarse aggregate of clean, dense, crushed rock, or gravel, ranging in size from one inch down. The concrete shall be thoroughly mixed, carefully placed and worked around the reinforcement. The forms should not be held together by wire, as is frequently done in building construction, because leakage is likely to take place along the wire. The concrete shall preferably be poured in a continuous operation so as to form a monolithic construction. [Note—Where this cannot be done, the bottom shall be poured without joints, and the walls as a second continuous operation. One method of making a tight joint between the bottom of the tank and the walls is by means of a strip of galvanized iron six inches wide, with joints riveted and soldered, so as to form a continuous band. This strip should be vertically embedded three inches in the floor slab and on the center line of the wall. The floor slab under the walls should be thoroughly cleaned, and before pouring the walls a mixture of 1:1 mortar should be placed in the bottom of the forms and around the galvanized strip to make a tight joint.]

"(c) Finish.—As soon as the wall and sides have been poured the floor shall be floated and troweled smooth. The wall forms shall be removed as soon as the concrete has hardened sufficiently to be self-sustaining, and all projections and irregularities shall be removed from the surface and all cavities filled with a 1:1 mortar, thoroughly rubbed in and troweled smooth. No plastering shall be applied.

"(d) Aging.—The concrete shall be allowed to harden at least thirty days and longer if possible.

[Note.—To assist in the setting of the concrete before it becomes oil soaked it is advantageous to use several priming coats of a 1:4 solution of 40 degree Be. sodium silicate, followed by a finish coat of 1:2 solution. This forms a glazed surface on the concrete which, although it is not permanent, gives the concrete an opportunity to harden until the protection from the silicate of soda is no longer necessary.]

“Location of Pipe Connections.—All pipe connections to the tank shall be made through the top.

“Venting of Tanks.—(a) Tanks shall be provided with a permanent open vent, or with a combined fill and vent fitting, so arranged that the fill pipe cannot be opened without opening the vent pipe.

“(b) Vent openings shall be screened (30x30 brass mesh or equivalent), and shall provide sufficient area for allowing proper flow of liquid during the filling operation. Permanently open vent pipes shall be provided with weather proof hoods and terminate at a point at least twelve feet above the top of the fill pipe, and never within less than three feet, measured horizontally and vertically, from any window or other building opening. Where a battery of tanks is installed vent pipes may be run into a main header. Individual vent pipes should, however, be screened between tank and header and connection to the header should be not less than one foot above the level of the top of the highest reservoir from which the tanks may be filled.

“(c) Fill pipe shall be screened, and when installed in the vicinity of a building shall not be located within five feet of any door or other opening and shall terminate in a metal box or casting projection with means for locking.”

Accident Prevention and Insurance

The first of a series of safety and welfare meetings of the Bureau of Accident Prevention and Insurance of the Portland Cement Association was recently held in Bethlehem, Pa. All the companies in the Lehigh district were represented, 70 persons being present. It is planned to hold similar meetings in various districts of the country. They are held under the direction of H. G. Jacobsen, manager of the department. The program discloses how interesting and valuable the first meeting was. Mr. Jacobsen talked about accident prevention and welfare work at cement plants and illustrated his remarks with slides. Dr. George E. Tucker, who had made a special study of the effect of cement dust on the health of employes discussed that subject. Dr. Walter O. Snelling talked on the safe application of explosives in quarries. S. N. Fowler explained and demonstrated the treatment for burns and wounds by Ambrine, a development of the war. Moving pictures of blasting and other operations at the Riverside Portland Cement Co. plant, Riverside, Calif., were shown.

Sauerman Bros., Monadnock block, Chicago, Ill., announce the return of Major D. D. Guilfoil to his old position as sales engineer. Major Guilfoil commanded the first battalion of the 108th Regiment of Engineers. This regiment, which was composed almost entirely of Chicago men, participated in two major operations in France, the Somme and Meuse-Argonne offenses. Major Guilfoil received his discharge at Camp Grant on June 7 and resumed his old job on June 9.

Concrete Bin for Storing Bulk Cement

Humboldt Gravel & Tile Co., Humboldt, Iowa, has designed an unusual concrete bin for storing and handling bulk cement. The bin is 18 ft. wide and 32 ft. high, with a capacity of 4000 cu. ft. From the ground up to the height of 18 ft. it is built of monolithic concrete, 8 in. thick, suitably reinforced. Above this point the wall is of Anchor 2-piece concrete blocks. In making same, reinforcing is placed in the air space between the two block sections, but in the bin construction the space was filled after blocks were set in the wall with cement grout, making a solid wall. The bin has a hoppers bottom, running down to a 9-in. screw conveyor, which carried the cement to a beam scale inside the plant. From this point it is distributed to the various mixers automatically by means of elevators and conveyors. A 24-in. belt conveyor runs to the top of the bin, to carry the cement from the freight cars, the unloading being done by a power grain shovel. Footings to carry the belt conveyor frame are built up of large drain tile filled with concrete.

Drainage Movements Planned

Nearly 4,000 acres of Mississippi delta soil will be reclaimed upon the completion of the Black Mayo drainage district's system, now under construction and expected to be completed by next January. Lately contract was awarded to the Delta Cement and Tile Company, Greenville, Miss., for building the \$25,000 pumping station required for this drainage system, and the engineer in charge is the Morgan Engineering Company of Memphis. Contract for the pumping plant equipment was awarded last December, and the machinery is now being built by New Orleans manufacturers. The acreage being reclaimed is in Washington county, Mississippi, and the pumping plant will be located at Hollandale.

Cement Companies Consolidate

Stockholders of Standard Portland Cement Corporation will meet this afternoon to ratify an arrangement by which the entire properties of the corporation will be taken over by the Santa Cruz Portland Cement Company. The committee, which has had the matter in hand for some time, comprises Andrew A. Moore, E. J. Schneider, Rudolph Herold Jr. and A. F. Morrison. These will recommend to their fellow stockholders that the offer of Santa Cruz Portland Cement Company of \$22.50 a share for the stock of Standard Portland Cement Corporation be accepted. The purchasing corporation will assume the debt of Standard Portland Cement and takes over everything belonging to that concern, including the plant at Napa Junction, California, with the 100 acres of land owned there. The capital stock of the Standard company amounts to 40,000 par value of \$100 shares, of which there are \$3,283,200 shares outstanding. Outstanding bonded indebtedness is \$65,000, assumed by the Santa Cruz company.

Standard Portland Cement Corporation was organized in 1907, taking over the properties of the Standard Portland Cement Company. The Santa Cruz Portland Cement Company was organized in 1905 and has an authorized and outstanding capital of \$5,000,000 in par value of \$100 shares.

Compressing Concrete Increases Its Strength

Plain Columns of Successive Layers Pressed Down
Average Half Again as Strong as Those
Poured for Full Length.

BY FRANK P. McKIBBEN,
Professor of Civil Engineering, Lehigh University,
Bethlehem, Penn.

Density in concrete being an acknowledged aid to strength, an effort was made in some recent tests to determine whether this desired density can be obtained by compressing the concrete during deposition. While it is admitted that there may be difficulties in applying the process to construction, the fact that the tests show that strength can be materially increased by successive compressing of layers may lead to further investigation.

The records herewith given cover two types of columns: First, "ordinary concrete" columns, made of 1:2:4 concrete in the usual way, of which five specimens were tested, and, second, "compressed concrete" columns made of identically similar 1:2:4 concrete but compressed during the process of molding, the compressive loads varying from 25,000 to 40,000 lb.—that is, from approximately 160 to 260 lb. per square inch of cross-section. Ten of these compressed concrete columns were tested, eight at the age of 28 days and two at the age of 56 days.

All columns were approximately 5 ft. long and 14 in. in diameter, and no reinforcement whatever was used in any of them. The concrete used in both the ordinary and in the compressed columns was of uniform quality, proportioned in accordance with Taylor and Thompson's tables of quantities for a 1:2:4 mixture. The fine aggregate was Delaware River sand, a material too fine for good results, but commonly used until recently in the Lehigh Valley. The large aggregate was extremely hard, crushed limestone of excellent quality, practically all of which passed a $1\frac{1}{2}$ -in. mesh, the dust being screened out. The molds used

means of a plunger. The pressure was allowed to remain on each successive layer for a few minutes, the plunger being then withdrawn; more concrete was spaded into the form, this in turn being compressed. Thus, the process of placing about 12 in. of concrete into the form and compressing the same was repeated five times to complete each column approximately 5 ft. in length. The plunger used in compressing the wet concrete was 13 in. in diameter, and the nominal inside diameter of the form.

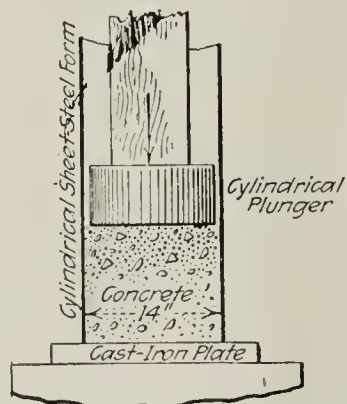
The forms were stripped three days after the columns were molded, the column then being kept in wet canvas for four days. During the rest of the 28 or 56 days, in the two cases, respectively, the columns were exposed to the air of the laboratory.

The columns were tested in the Lehigh University 800,000-lb. vertical screw machine in a standard manner. Longitudinal and lateral deformations were measured.

TABLE I. TABULAR VIEW OF ORDINARY CONCRETE COLUMNS
— At Time of Testing —

Column Number	Water Per Cent.*	Wt. of Column, Pounds	Wt. of Column, Lb. Cu. Ft.	Age in Days	Length, Feet	Diameter, In.	Ultimate Compressive Strength, Lb. per Sq. In.
P-1	8.6	...	...	28	5.0	14.56	2,390
P-2	7.9	...	...	28	5.0	14.34	2,420
P-3	8.0	851	147	28	5.0	14.58	1,640
P-4	...	888	147	28	5.02	14.81	1,240
P-6	8.0	815	147	28	5.0	14.25	1,180
Average,	8.1	...	147	...	...	...	1,774

* Ratio of water to cement plus sand plus stone



METHOD OF APPLYING
PRESSURE TO CONCRETE

were of sheet steel rolled into cylindrical form, care being taken to prevent the loss of water by making the forms tight.

The ordinary concrete columns were molded by spading concrete into the forms and tamping with an iron bar. Each compressed concrete column was molded in five layers, each layer being about 12 in. deep, and as each was placed in the form a pressure was applied to the upper surface of the concrete by concrete, a gain of 906 lb. per square inch, or 51%.

Tables I and II give the main data of the tests. It is interesting to compare the weight of 147 lb. per cubic foot for the ordinary concrete columns with the average of 153 lb. per cubic foot for the compressed concrete columns, a difference of 6 lb., or about 4 per cent.

The compressed concrete columns failed more suddenly than the ordinary columns, and whereas in an ordinary concrete column failure occurs by crushing or by shearing on inclined planes the compressed column splits longitudinally on a diametrical section for a considerable portion of its length. The compressed concrete contains perceptibly fewer air spaces than does the ordinary concrete. Moreover, although the limestone was of very hard quality, practically all stones on the fractured section were pulled in two. Seldom in compressed concrete did stones pull out of the mortar.

The advantage of compacting the concrete is clearly shown by the high ultimate strength of the compressed concrete. For 28-day ordinary columns the average compressive strength is 1,774 lb. per square inch, as compared with 2,680 lb. per square inch for compressed

TABLE II. TABULAR VIEW OF COMPRESSED CONCRETE COLUMNS.
— At Time of Testing —

Column Number	Water, Per Cent.	Load Used to Compact Columns, Lb.	Aver. No. of In. Column Compacted at Each Application	Wt. of Column, Lb.	Wt. of Column, Lb. Cu. Ft.	Age in Days	Length, Ft.	Diameter, In.	Ultimate Compressive Strength, Lb. per Sq. In.
C-7	8.6	25,000	—	808	150	28	5 00	14 06	2,360
C-8	9.2	30,000	—	754	149	28	4 67	14 09	2,520
C-9	8.2	35,000	—	732	150	28	4 56	14 05	2,900
C-10	8.9	25,000	—	733	149	28	4 60	14 00	2,150
C-11	7.8	30,000	—	751	152	28	4 58	14 07	2,560
C-12	6.8	35,000	—	765	155	28	4 61	13 99	2,930
C-15	6.8	35,000	—	773	158	28	4 67	13 88	2,500
C-16	6.8	40,000	—	775	153	28	4.67	14 10	3,550
Average.....									2,680
C-13	6.5	25,000	0 1/4	763	155	56	4.60	14 00	3,590
C-14	6.0	30,000	0 1/8	790	154	56	4.79	14 00	4,940
Average 7 6					153				4,265

Contrast this 51% increase in strength with the 4% increase in weight. It is quite evident that compacting is very effective.

Now refer to Table III, wherein compressed concrete columns are grouped with the compacting load

Column Number	Age in Days	Compacting Pressure, Pounds	Ultimate Compressive Strength, Lb. per Square Inch
C-7	28	25,000	2,360
C-10	28	25,000	2,150
Average.....			2,255
C-8	28	30,000	2,520
C-11	28	30,000	2,560
Average.....			2,540
C-9	28	35,000	2,900
C-12	28	35,000	2,930
C-15	28	35,000	2,500
Average.....			2,780
C-16	28	40,000	3,550
C-13	56	25,000	3,590
C-14	56	30,000	4,940

as a basis. It is here revealed that a molding compression of 25,000 lb. produced an ultimate strength of 2,255 lb. per square inch; a molding compression of 30,000 lb. produced an average ultimate strength of 2,540 lb. per square inch; 35,000 lb. pressure gave an average of 2,780 lb. per square inch for three columns, C-9, C-12 and C-15. Observe that with the compacting load of 40,000 lb. for column C-15, the resulting compressive strength was 3,550 lb. per square inch, a value almost exactly double the average of the five ordinary concrete columns.

For C-14, age 56 days, the ultimate compressive strength is 4,940 lb. per square inch, nearly three times the strength of ordinary concrete at the age of 28 days. Of course, the element of time enters into this high compressive strength for C-14. The accompanying diagram illustrates even more strikingly than does Table III the effect of compacting the concrete. A careful study made by the writer shows that stress deformation curves for the compressed concrete columns are much more nearly straight than the corresponding curves for the ordinary concrete columns, many of the curves for the former being fairly straight almost to the ultimate strength.

Moduli of elasticity corresponding to unit compressive stresses of 500 lb. per square inch are shown in Table IV.

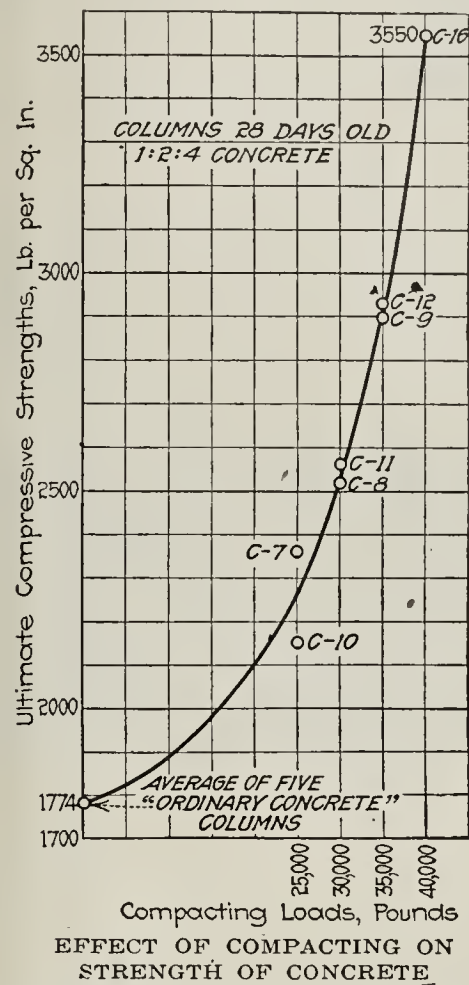
Additional tests on compressed concrete should be made to determine the proper amount of water to be used in mixing, the maximum intensity of load permissible during molding and the effect of using com-

pressed concrete in spirally reinforced columns. It seems certain that up to some point not yet determined increased ultimate strength follows with increased loads for molding, but beyond that critical

Column Number	Modulus of Elasticity Lb. per Sq. In.
C-7	3,555,000
C-8	4,083,000
C-9	3,480,000
C-10	3,405,000
C-11	3,506,000
C-12	5,647,000
C-15	5,743,000
C-16	4,788,000
Average.....	4,276,000
C-13	3,474,000
C-14	3,606,000

*When tested, all columns were 28 days old, except C-13 and C-14, which were 56 days old.

mined increased ultimate strength follows with increased loads for molding, but beyond that critical



point the excessive pressure may remove so much water as to leave insufficient for proper hydration of the cement.

Assistant Professor M. O. Fuller of Lehigh University and former students W. A. Stickel, C. W. Tanner, P. M. Teeple and C. R. Uhl deserve all credit for making these tests.

Adding New Jaw Crusher

The General Crushed Stone Co., LeRoy, N. Y., is adding a new 48x60-in. Traylor jaw crusher to its plant in this place. The crusher is to be located in the quarry to the west of the present dumping hopper and incline to the quarry plant. A pan conveyor will carry the discharge to a bin over the cable-car skips. This crusher and conveyor will be driven by a motor. A 250-h. p. cross compound engine and a direct-connected generator have been added to the power plant equipment; also a 150 h. p. boiler. The new unit is so arranged that it can be used or not without interfering in any way with the present layout.

USING PROGRESSIVE IDEAS

Building Supply Yard of Washburn Bros. Co., Jersey City, N. J., Presents Interesting Example of Modern Enterprise—Here Efficiency Has Been the Watchword and No Stone Has Been Left Unturned to Effect Maximum Results With a Minimum of Labor and Expense in Handling Material



Ideas, plans, methods, enterprise and progressiveness — these are words of broad significance and possibilities. They imply terms which any line of business well may heed to be successful, and among the various industries the building material field stands prominent. In addition, co-operation and co-ordination have become the order of the day in modern business; these are primary requisites for profitable activities, going hand in hand with progressive attainments and spelling success in the making.

Present day conditions coupled with keen competition demand that the old ways of doing this or that must give place to the trend of development if the business is to be conducted along advantageous and remunerative lines. Now as possibly never before is careful and considerate judgment needed in the operation of the building supply business; and now is the time, while things in general in this line are quiet, to absorb and utilize the best that modern practice affords, whether it relates to office, yard equipment or any other phase of work.

Don't wait, do it now, before it's too late, when this line of business takes leaps and bounds, as it surely will, regaining the status and effort it has lost, there will be little, if any, time for uninterrupted study and consideration of new ways and means, new devices or necessary instal-

lations for betterment and efficiency in operating conditions. Today, the building material industry, as a whole, is not "rushed with work" and while time hangs heavy, it can be placed decidedly to excellent ends, paying dividends later.

Every factor going to make up the building supply business is worthy of consideration—and most careful consideration and thought. A question such as "Is this the best and most efficient way?" will often find an answer in "No," and correction should follow. But frequently no steps are taken toward improvement until many, many dollars have been wasted. It may be that little leaks or inefficiencies will be found in the unloading or handling of materials, storage facilities,

transportation system, or in other phases of yard and office operation, where slight revision in method or installation of inexpensive equipment might work to a decided contrast. It may be the means of saving many dollars annually in labor, operating and other costs. Look around and see what your yard has and what it is doing.

Again, what an excellent opportunity is offered in slack periods for co-operation with customers and prospective customers — the mason, carpenter and builder, those who purchase building materials. It is a chance to extend the circle of business friends and to cement a spirit of good fellowship for future

mutual benefit. This co-operation and all that goes with it cannot be given by waiting around the office for some one to come in, but by making the rounds.

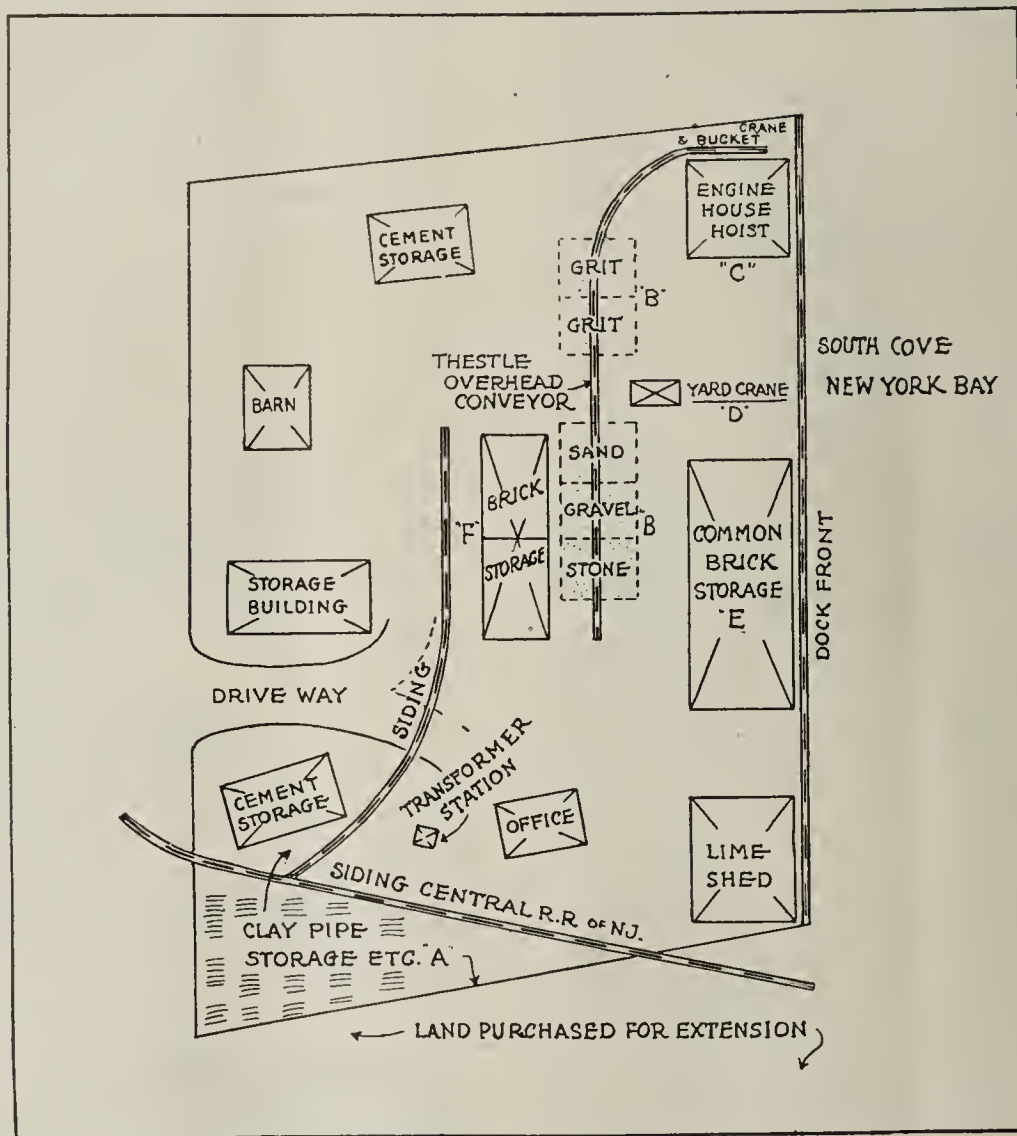


Chart of Washburn Bros.' Yard, Jersey City, N. J., Showing Efficient Arrangement for Speedy Service.

and calling on them. The same thought applies when material is being furnished for a building or other construction work—frequent visits should be made to the site to learn if material, delivery or any other item is satisfactory. These activities may or may not bring immediate orders and re-orders, but certainly they are bound to help, gaining a point of contact that will not be broken easily.

Washburn Brothers' Yards

The building supply business of the Washburn Brothers Co., Jersey City, N. J., presents an interesting and illuminating example of modern enterprise and progressiveness; every phase of operation, reaching from yard to delivery of material is actuated by the same spirit. Here efficiency has been a watchword and no stone left unturned to effect maximum results with a minimum of labor and expense. This business, established in 1854, is a profitable one, and certainly it deserves to be. The local yard of the company, with which the following deals, should be of decided interest to every building supply dealer.

This yard, located at the foot of Jersey Avenue, is situated on an ideal site, having both rail and water facilities. The accompanying line illustration gives an idea of the layout of the property which covers an area of approximately 400x1,000 feet. Railroad sidings lead to all parts of the yard, connecting with the lines of the Central Railroad of New Jersey. The dock, or waterfront, totals about 500 feet in length, being known as the South Cove, an extension of New York Bay, and affording ready access to all parts of water transportation.



Glimpse of Frame Housing Used for Unloading Material as it Arrives on Scows and Barges.

One section of the yard, noted as "A" in the diagram, is given over to the storage of clay products. Here, in the open, such products are kept as flue lining, hollow tile, clay sewer pipe, building blocks, wall cop-

ing, and similar other commodities. This material usually is delivered to the plant by rail; the cars are put on the adjacent sidings and unloaded by means of skids to the different sections of the storage yard as arranged for the various products. The material, as will be understood, is slid from the cars on the skids to the proper location.

Sand and Gravel Conveyor

The sand and gravel handled by the company comes in on barges from Cow Bay, a well-known point of sand production in the vicinity of Long Island. This material is unloaded at the dock and placed in storage by an interesting and effective car conveyor system. The system consists of an overhead wood trestle with railroad track, such being about 350 feet long and located directly over the hoppers or storage pits for the different materials, which consist of sand, gravel, three-quarter inch stone, one and one-quarter inch stone, and grit; each of these materials has its own individual storage location, noted as "B" in the line illustration.

A small engine house is located along the dock front, indicated as "C" in diagram, with installation consisting of a vertical boiler operating a hoisting engine. This steam hoist, provided with drum and wire rope, serves for the operation of hoisting and conveying ap-



Labor-Saving Yard Crane Which Saves Time, Labor and Costs.

paratus at the top of the building, a man being stationed at this point to guide the work. A clam-shell bucket is used for lifting the sand or other material from the barge, hoisting it to the top and discharging in an overhead hopper. By gravity flow, this hopper delivers the material to a dump car which runs on the trestle track. This dump car has an inverted iron V-shaped interior, with the top of the V flush with the top of the car, and with tilting sides hinged at the top to open and allow for the discharge of the contents. The car operates on the track by gravity. A tripper or jigger arrangement is attached to the bottom of these sides, which comes in contact, as the car arrives at the desired location of the trestle, with a small arm or corresponding jigger on a wood frame attached to the trestle. This contact automatically releases the sides of the car for unloading. The wood frame is detachable from the trestle, being placed in the proper location for the discharge of the material into the proper storage pit, as sand, gravel, or as the case may be.

The operation is as follows: the dump car, as soon as loaded from the hopper connecting with the barge, is sent along the track, moving at a rapid rate of speed,

stopping when the tripper device comes in contact with the sides of the car; these sides fly open and the material is discharged at once from the inverted V-shaped interior. By the time this operation is completed, taking but a few seconds, the sides drop to their normal position, while weights at the far end of the trestle send the car back for another load, a man being located near the terminus or loading point, to stop the car in position as desired. This entire operation is accomplished in less than two minutes.

With this system, 500 yards of sand, gravel, or other material, can be handled per day, requiring three men for operation. It is a highly effective means of conveying, and in decided contrast to the unloading of scows with wheelbarrows and hand labor, as so frequently found. An electric operated winch has been installed in the engine house for turning the barges around, unloading first from one side and then from the other.

Yard Crane for Loading Trucks

In connection with its sand and gravel business, the company uses a portable yard crane. This equipment consists of a wood housing mounted on an I-beam frame, attached to trucks with iron wheels. The hoisting apparatus is motor-driven. The crane, located at the front, operates on a bull wheel, and is provided with a clam-shell bucket. This equipment usually is stationed at a point noted as "D" in the accompanying illustration, having sufficient radius to reach all the neighboring hoppers, and move under its own power to other locations, as may be desired. This yard crane is operated by one man.

An idea of the sufficiency of this crane for the service intended is obtained when it is stated that it loads a truck in about two minutes as against one-half hour as required by hand shoveling, estimating a truck to be worth about \$2.50 per hour, the saving, including power and operation, etc., readily can be appreciated.

Portable Wagon Loader

A small portable wagon loader is also operated in this yard, consisting of a series of gravity-discharge



View Showing Opposite End of Trestle, Showing Sand Pit or Bin, and Still Farther Along, Gravel Pits.

buckets mounted on a chain elevator. This equipment is electrically-operated, service being obtained from feed lines running overhead parallel to the wood trestle. In this connection a novel electric attachment consisting of a wood framework with lines tapped from the feed wires, operates on a trolley for the entire length of the service wires, or approximately the length of the trestle. The cable connections at the bottom of this frame are for the attachment to the portable

wagon loader, allowing operation at any point within a few minutes notice.

This portable loader is used when the yard crane previously referred to is employed elsewhere, and is primarily for emergency service in the quick loading of sand, gravel, etc., on outgoing trucks.

Yard Buildings

Along the dock front a series of brick storage sheds are arranged for common brick and noted "E" in the diagram. These sheds have a storage capacity of about 4,000,000 brick at one time. It is interesting to note that the company has a large brick manufacturing plant at Glasco, N. Y., located on the Hudson River, with a capacity of about 90,000,000 common brick per season. Between this point of the Jersey City yards, the company operates in normal times ten barges having a capacity of about 500,000 brick each. Under regular operating conditions when brick is in constant demand, loading is accomplished direct from the barges to wagons or trucks, and but little material held in storage.

The same holds true for the sand and gravel end of the business. In normal times, there is not much occasion to store considerable of this material, and outgoing trucks are loaded direct from the scows at the dock front by means of the hoisting equipment previously referred to. The company handles about four boatloads of sand a week, or approximately 2,500 yards.

The different yard structures consist of a total of eight buildings and two storage sheds, as will be noted in the line illustration. The various storage buildings are for perishable goods, including barreled commodities and ton material. The shed holding the brick that comes in cars is located on one of the yard sidings, designated as "F," and used for face brick and fire brick.

The lime shed is situated on the dock line, adjoining the brick storage sheds, mentioned above. This location provides for utmost facility in operation; the barrel lime is rolled from the boats on skids into the storage building, while hand trucks are employed for the lath mortar. Other storage buildings are used for cement, expanded metal lath and other commodities. About 2,000,000 wood lath usually are carried in stock.

A barn for company teams is placed at a convenient point, with facilities for 20 horses. Modern equipment is provided in this structure, including an oats crushing machine; it is stated that by feeding crushed oats instead of whole oats, no colic is experienced among the horses and a horse has never been lost through this ailment.

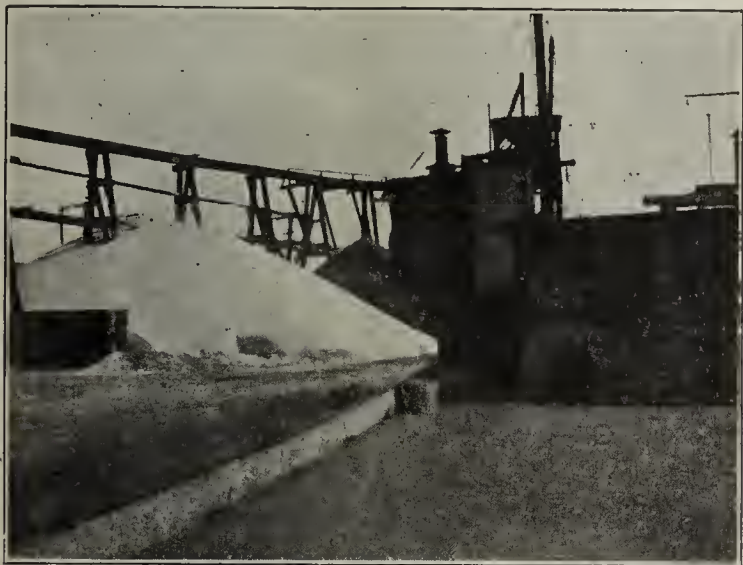
Electrical energy for operation is secured from the Public Service Electric Co., which operates a system thruout this territory. A transformer house is located near the office, as indicated in the line illustration. The company has recently acquired additional property adjoining the yard to allow for future expansion. Carrying out the general policy of orderly arrangement and cleanliness, a yard hose is provided, and this is used regularly from day to day, as required, to keep the property clean and presentable.

General Operating Features

The company is now operating its local yard with five men, including foreman and laborers. It has been possible to reduce the force to this number not on account of curtailment in building work entirely, as might be supposed, but rather thru the installation of different labor-saving equipment, as noted, and general operating efficiency. At the present time material is being furnished to five or six large jobs, where the building work is well under way. The extensive business and facilities of the organization can be imagined

when it is stated that at different times building specialties have been supplied to twenty-five and thirty locations, for big contract work, at once. Material from the yard has been shipped as far as Bridgeport, Conn.

A regular feature of the business is keeping in contact with contractors, both large and small, to whom material is being furnished, offering co-operation in every possible way and seeing that complete and satisfactory service is rendered. Three roadster automobiles are in constant use for this and kindred purposes, with the result that the company has the largest business of any concern in the building supply line in the county. Never a day goes by but that calls on customers and prospective customers are made, and when building materials are needed Washburn Brothers naturally come first to mind. The company deals almost exclusively with contractors, and has no direct consumer business.



View of Frame Trestle on Which Car Operates. Taken at Loading End.

Under normal conditions, five automobile trucks and ten wagon teams are in use. Automobile trucks, unquestionably, are the more efficient for regular haulage service, excepting in the case of short distances, say about one-half or three-quarters of a mile, when horses are more economical. A cartage charge is now operative at the yard, based on a zone system. This ranges from a minimum of 50 cents for a short haul to \$1.50 for long distance, with an intermediate charge of \$1.00 in the zone between the two points. A price varying from \$1.25 to \$2.00 per thousand is made for carting brick. The company handles its own common brick exclusively. Officers of the company are John T. Washburn, president; Richard C. Washburn, vice-president, and Louis H. Washburn, secretary, treasurer, and manager of the Jersey City yard. I. B. Scott is assistant manager at the local plant.

The general operating features of this progressive building material yard should present ideas and suggestions to other building supply dealers. The up-to-date, up-to-the-minute way is the right way, and this is one reason why it is an easy matter to out-distance neighboring competition which insists on operating under a hit-and-miss plan, and methods long since obsolete.

Should Build Roads to Meet Requirements Ten Years Hence

"Roads must be built with the requirements of ten years in the future in mind," says R. E. Fulton, Vice

President of the International Motor Co. "There are 500,000 motor trucks in use in this country and it is estimated that within the next five years the number will not be less than 4,000,000."

"We have seen the impossibility of keeping traffic down to what roads will stand," said Mr. Fulton. "Roads exist to serve the needs of the people, which can hardly be restricted to road conditions. Roads must be built up to traffic requirements, with the idea of transportation economy in mind. Low cost of road building that means high cost of transportation is penny wise and pound foolish."

"Where light vehicles are sufficient for the requirements of the traffic comparatively little road repairing is necessary; but where the traffic is heavy the roads must be built to stand it. The greatest economy in transportation lies in large units. One driver operating a large truck does the work of two or three operating small trucks. The maintenance, rent, and operating costs of a large truck are much smaller in proportion than for a number of smaller trucks providing equal capacity. It is an established fact that a 50 per cent increase in capacity gives a 15 per cent decrease in transportation costs. Fifteen per cent saved on all motor transportation where larger units are needed would mean a saving of several hundred million dollars each year to the people and effect a substantial reduction in the cost of living."

"The weight motor trucks impose on road surfaces is limited to 800 pounds per inch width of tire. Consequently a large truck exerts no more relative pressure on the road surface than a small one."

New Publication; Scoop Conveyor

"Over 1,000 Scoop Conveyors" is the title of a 20-page folder just published by the Portable Machinery Co., Passaic, N. J. This folder, replete with illustrations showing the various uses of the Scoop Conveyor, describes clearly the labor, time and money-saving features of the machine in storing, reclaiming, loading and unloading material such as coal, coke, ashes, sand, gravel, crushed stone, fertilizer, cement, chemicals, etc. Thirty-two letters from users are printed testifying to the merits of the machine and eighty-four letterheads representing additional concerns who have written commendatory letters are reproduced.

Marcus S. Wright, South River, N. J., says: "We use the Scoop Conveyor to load industrial cars with sand direct from the bank and find it a very handy machine, as we load from either the end or sides of these cars, and we can take a sweep of about 15 feet ahead and on either side. Before using the machine it required six men to load the cars with a continual shifting of track, and now, with the conveyor, three men are able to keep the cars loaded continually without loss of time, which enables us to get out a much larger tonnage with one-half the labor."

Copies of the folder will be sent gratis to those interested, upon request to the manufacturers, The Portable Machinery Co., Passaic, N. J.

New Cement Company at Montreal

The Montreal Portland Cement Company, Ltd., has been incorporated with a capital of \$2,000,000. The promoters of the company state that a site of 52 acres has been secured at Pointe-aux-Trembles, near Montreal, and that it is proposed to erect a plant of 5,000 barrels a day capacity, the plans having been prepared.

New Concrete Terminals at Norfolk

Architects, contractors, builders, artisans and others who have visited ports on the Atlantic and Pacific coasts declare that Norfolk possesses terminal shipping facilities that are both unique and incomparable.

These terminals were built by the government for war purposes at a cost of \$30,000,000. They are situated on a site six miles from the city of Norfolk, on Hampton Roads, and cover about 640 acres. There are six warehouses, none of which is less than 1,400 feet in length and several of which are 1,680 feet long.

In the larger eastern cities, such as New York, Boston, Baltimore and Philadelphia, the government constructed its warehouses on the perpendicular plan, with story upon story, this architectural plan being necessary because of the lack of ground space and the value of the land in those cities, but in Norfolk the government had the use of a vast area on the shores of Hampton Roads, and it built the warehouses at the army supply base near this city on the horizontal plan, each one of the six buildings being long and low and only of one story.

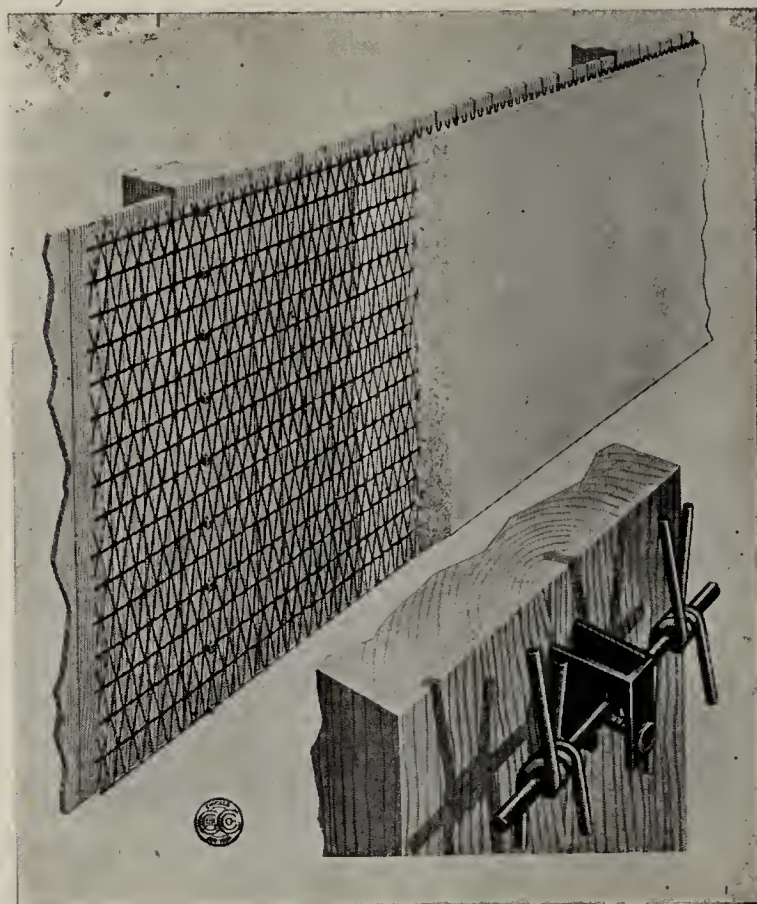
The one-story warehouse gives greater facility in the handling of all manner of shipments and eliminates all elevator service. The warehouses at the army supply base near Norfolk are also completely equipped with electrically operated machinery for transporting supplies from the warehouses to the ships at the piers, and the ships are loaded and unloaded also by electrical machinery.

Being thus equipped, vessels can be loaded and unloaded at these terminals in one-sixth of the time usually required at other terminals according to one of the electrical engineers employed in equipping the army supply base terminals with electrical machinery.

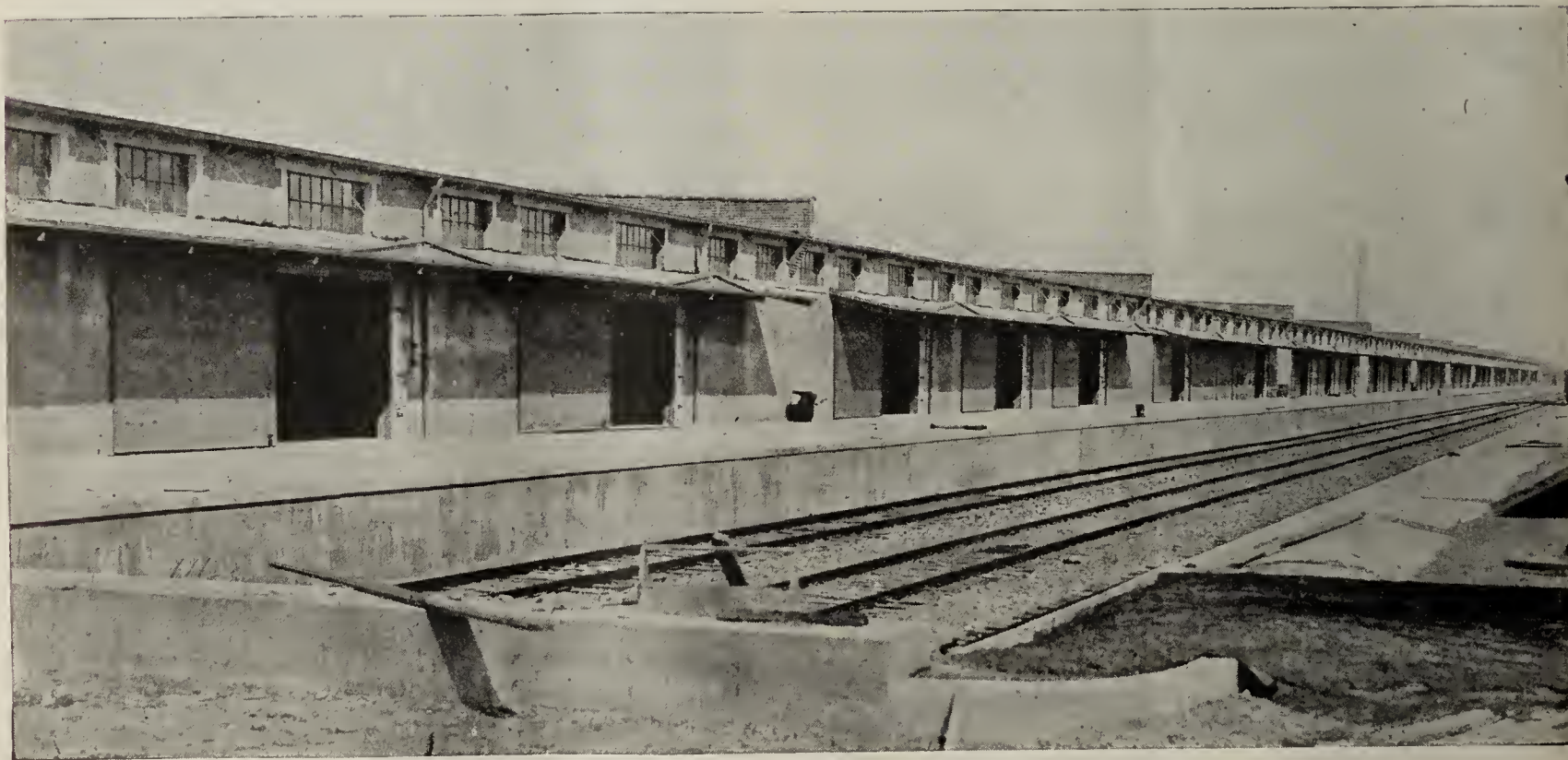
John V. Schaefer, president of the Cement-Gun Construction Co., of Chicago, which company had the contract for the concrete work on the immense warehouses, declares that the terminals here are the best

equipped in this country and that there is nothing to compare with them anywhere in the world, not only because of the terminals being constructed on a different plan from all others, but because of their more complete and modern facilities for handling supplies.

When the construction division of the United States Army was beginning the construction of the



Diagrammatic View, Showing Method of Attaching Wire, Method of Forming and a Section of Gunite Wall in Process of Being Shot.



Warehouse No. 5 from Water End; Tile Building, Stuccoed with Gunite.



Warehouse No. 6 from Water End; Wood Frame with Gunitite Walls.

government's warehouse projects at various ports in 1917 and 1918, the transportation system of the country was seriously congested. Every consideration had to be given to the use of such materials and to the employment of such designs as would cause the least possible burden to railway service.

The weight of the eight-inch tile that would be required to build the walls of the warehouses proposed for the army supply base at Norfolk exceeded 13,000 tons. Since tile has to be hauled a considerable distance by rail and since sand was plentiful at the proposed site, it was decided to begin building the warehouse walls of gunitite.

Gunitite, the product of the cement-gun, consists of one part of cement mixed with three and one half parts of sand. The mixture is placed in the cement-gun

dry; it is then blown through a hose with an air pressure of about 45 pounds, water being added in the nozzle. In this way the mixture goes through the hose dry, but the projected material as it strikes is mortar.

From this it will be seen that about three-fourths of the bulk and the weight of material required for the granite will consist of sand. In this way transportation of materials for these walls was limited to cement and reinforcing wire mesh.

An order was placed for the gunitite walls for one of the buildings, leaving the decision open as to the construction of the other buildings until the success of the cement-gun process had been fully demonstrated.



Gunitite Roof in Process of Formation, 42 Ft. Wide, 1,280 Ft. Long, Over One of Center Bays. Cement Gun in Operation.

GOODRICH



CONVEYOR BELT

Goodrich De Luxe
Truck Tires; ride
easier; wear longer;
run faster
without damage
to tire and truck;
save engine power
and fuel.

“LONGLIFE” spells economy in every detail of its construction. Once properly installed the man in charge can feel satisfied there will be no mechanical or labor charges placed against the operating cost of “LONGLIFE.”

THE B. F. GOODRICH RUBBER CO.
The City of Goodrich—AKRON, OHIO

"LONGLIFE"



TROUGHS OF ITS OWN WEIGHT

Goodrich "LONGLIFE" Conveyor Belt troughs to the idlers naturally of its own weight. It always runs straight and true if properly adjusted when placed on idlers.

THE B. F. GOODRICH RUBBER CO.
The City of Goodrich—AKRON, OHIO

The army supply base proper consists of eight warehouses and two piers, with their adjunct of barracks and other buildings. As finally built, six of the warehouses are of wood frame construction with gunite walls. The other two buildings were designed to be used for materials which might require artificial heat. One of these, therefore, was constructed of brick, and the other of tile. Five of the buildings are 1,400 feet long each, and the other three are 1,580 feet in length. All of the buildings are 160 feet wide.

In each warehouse a brick curtain wall cuts entirely through the building every 140 feet, projecting above the roof, so that a fire originating inside of one of these buildings would necessarily be confined to one 140-foot section.

Warehouses 1, 2 and 3 and 6, 7 and 8 are wood frame with gunite walls. No. 4 is of brick and No. 5 is of tile. The No. 5 building, the walls of which consist of tile, was stuccoed on the outside with the cement-gun in order to thoroughly weather-proof the walls.

The construction of warehouses 1, 2 and 3 and 6, 7 and 8 consists of a wood framing. Wood posts 10 feet on centers carry girts and caps and roof joists. The roof joists are covered with three-inch plank roof covered with tar. To the posts and girts there is secured triangular mesh. This is held in place with wire nails and so-called wire chairs. These hold the wire securely in place one-half inch away from the wood. Wooden forms are placed on the inside of the building about one-half inch away from the mesh. Gunite is then shot in place from the outside to a total thickness of about two inches. This makes a two-inch reinforced concrete wall of great strength and density with wire mesh reinforcements nearly in the center.

The wooden forms are made in movable panels, which are stripped any time after 24 hours and moved

from section to section. An illustration herewith shows the method of forming and wiring diagrammatically.

The total length of walls and ends formed with the cement-gun is 19,920 feet. The area is approximately 232,000 square feet. The sand was dug right on the spot at a cost of approximately 30 cents per cubic yard.

While the original order was only placed for one of the buildings, the first work done was so favorably regarded that the order was extended to cover all six warehouses, including also a gunite weather protection on Warehouse No. 5, the tile building referred to.

The two piers, each of which extend into the harbor of Hampton Roads to a length of 1,280 feet, and into deep water, are covered with sheds of steel construction. Each of these two sheds consists of one center bay and two side bays, the center bay extending above the roof of the side bays in the form of a monitor. There is an outside wall extending from the top of the parapet down about 11 feet, below which is a continuous line of doors. On each side of the center bay and between it and the side bays, and extending from the monitor windows down about 12 feet to a point below the side-bay roof trusses, are curtain walls acting as smoke-deflecting walls and screens, the purpose being to deflect the smoke from the locomotives which pass through the center bay so as to make it go through the monitor windows and ventilators. The roofs on the side bays are of slow-burning wood construction similar to the warehouse roofs. Three-inch plank is nailed to heavy roof purlins secured to the upper chords of the steel trusses. Tar and gravel roofing is placed over the plank. The center bay, through which run three railroad tracks, has a concrete roof.

Every eighth truss in the side bays is made into a fire stop by encasing it in cement up to the roof line.



Outside wall on water side of Pier No. 1. Two nozzle operators are applying the Gunite. One cement finisher is smoothing off any chance irregularities, after which the wall is flashed to a finished surface.

The favorable work done with cement-guns on the warehouses caused them to be used for building outside walls, smoke-screen walls, fire stops and roof over center bays. This work covered a total area of 285,000 square feet.

An illustration herewith shows an outside wall in the course of construction. It will be noticed that in a number of places this wall is extended to the floor line. At these points offices and toilet-rooms are built into the structure. At all other places the doors are continuous. The high structure shown in this view is used for cargo hoists.

No. 26-A triangular mesh was used throughout on the piers as well as on the warehouses.

The outside walls and smoke-screen walls were formed and shot in the same way as described for the warehouses. The roof structure over the center bay consisted of I-beam purlins seven-foot centers. Forms were placed between these I-beams snug up against the underside of the flange. The wire mesh was placed in continuous ribbons running from eave to eave, supported three-quarters inch above the I-beam on wire chairs, with a dip or camber towards the center of the span of about one-half inch. The thickness of gunite is $2\frac{1}{4}$ inches.

A test panel of this $2\frac{1}{4}$ -inch gunite roof showed remarkable strength. At a uniformly distributable load of 164 pounds per square foot there was a deflection of five-eighths of an inch with slight cracking. At 209 pounds per square foot the deflection was $1\frac{5}{8}$ inches at the center, with many cracks perceptible on underside, but when the load was removed the slab came back to a level position, with no damage perceptible on the top surface. This test was made 11 days after shooting the gunite.

Apron Conveyors Catalog

The Jeffrey Manufacturing Co., 914 North Fourth street, Columbus, Ohio, are mailing out copies of their new catalog, No. 258, on Standard Apron Conveyors, which is now ready for distribution to the trade.

This catalog contains 75 pages, devoted to installations showing Standard Steel and Wood Apron Conveyors in service in various industries, specifications, general dimensions and other important data of vital interest to the purchaser.

The Jeffrey Standard Apron Conveyors, both of steel and wood flights, are so arranged in this book that not only the engineer, but the layman, who is more or less unfamiliar with conveying machinery, can easily select a conveyor which will completely meet his requirements.

There are no confusing tables to contend with. On pages 4, 5, 6, 7, 8, 9 will be found some important notes to aid the purchaser in selecting a conveyor.

This catalog will be of special advantage to the purchaser as he will save the time and expense heretofore required in making drawings and layouts for his own particular needs. In addition the purchaser is further benefited by quick delivery and saving in special designing cost made possible by placing Jeffrey Standard Apron Conveyors upon a manufacturing basis.

Announcement

Sauerman Bros., 1139 Monadnock block, Chicago, Ill., well known in the sand and gravel field as manufacturers of the Sauerman Dragline Cableway excavators, announce that their business will be continued without interruption under the same management as formerly, since the death of Captain Henry B. Sauerman, a member of their firm.

Electric Plant for a Stone Quarry

The Blue Mountain Stone Company, R. J. Funkhouser, vice-president and general manager, First National Bank Building, Hagerstown, Md., has just started the construction of a grinding mill for reducing into granules for roofing purposes a green stone commonly known as basic rock for copper deposits. The quarry is located on Jack's Mountain, one of the South Mountains, a part of the Blue Ridge system. The mill and quarry property are at Charmian, Pa. The new mill will be three stories in height, 35 by 155 feet. The company will use electric motor drives, with current from the power company at Hagerstown. Part of the machinery will be in groups, with shaft connections, and part with individual drives.

Orders have been placed for two 100 h. p. motors, one 40 h. p., one 30 h. p., one 15 h. p. and one 5 h. p. motor, all Allis-Chalmers make. The crushing machinery consists of one No. 6K Gates gyratory crushers, from the Allis-Chalmers Company, followed by one 24 by 13 jaw crusher, one set of 36 by 16 crushing rolls, three sets of 36 by 16 Sturdevant rolls and steel elevators and conveyors, also Sturdevant equipment. The air compressor and hoist are in a detached building, 30 by 30 feet. Both are motor driven, 40 h. p., on the conveyor and 30 h. p. on the hoist. The transmission line for the power is $5\frac{1}{2}$ miles in length, from the company's property to the power company's line connection near Waynesboro, Pa.

The company is opening new quarries. Construction work on the mills has already been started and a spur track has been completed into the quarries from the Western Maryland Railroad. It is hoped that the work can be completed and production begun by June 15.

New Booklet

Designing Concrete Mixtures

DESIGN OF CONCRETE MIXTURES—By Duff A. Abrams, Professor in Charge of Laboratory, Lewis Institute. Chicago, Ill.: The Institute. Paper; 6 x 9 in.; pp. 20; illustrated.

Every concrete engineer, or contractor working in concrete, should get a copy of the full report, for study. Professor Abrams has been conducting a monumental series of tests on the properties of concrete, and has announced some very definite views, backed up with laboratory facts. Some of these views are going to be subjected to searching inquiry in the next few months, and the controversies which will arise will undoubtedly be among the most alive of any that have stirred the concrete industry. It behooves every one interested to be well informed, therefore, on the basic tests reported here.

The Portable Machinery Co., Inc., Passaic, N. J., has just issued a 20-page folder entitled "Over 1,000 Scoop Conveyors." This folder, which is replete with illustrations, shows the various uses of the scoop conveyor, describing clearly the labor, time and money saving features of the machine in storing, reclaiming, loading and unloading material such as coal, coke, ashes, sand, gravel, crushed stone, fertilizer, cement, chemicals, etc. Thirty-two letters from users are printed, testifying to the merits of the machine and 84 letterheads, representing additional concerns that have written commendatory letters, are reproduced. Copies of the folder will be sent free to those interested, upon request to the manufacturer, the Portable Machinery Co., Inc., Passaic, N. J.

Marble Cliff Quarries Company Now Producing Pulverized Limestone

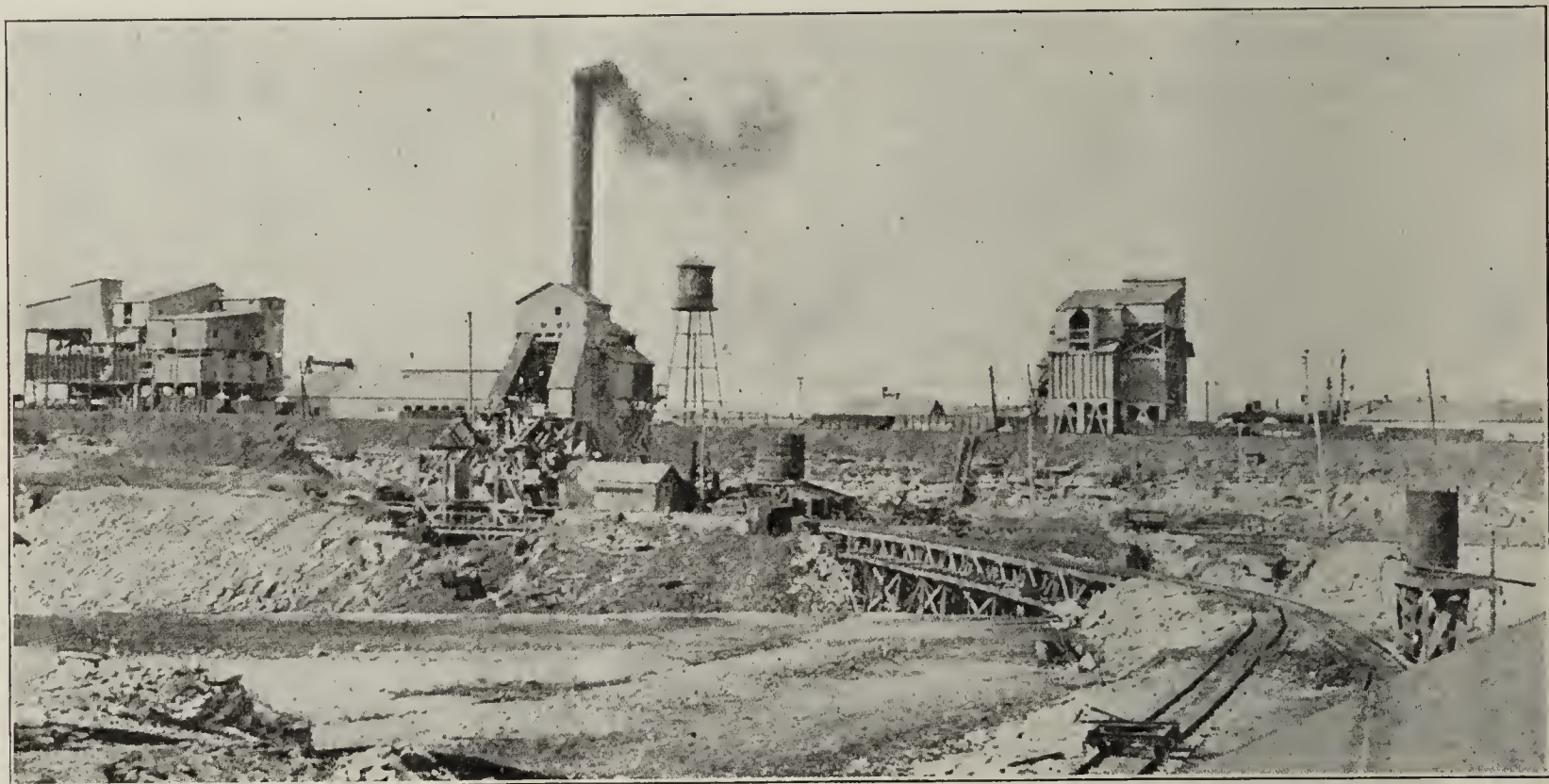
The Marble Cliff Quarries Company, Columbus, Ohio, which operates one of the largest limestone plants in the country, has elected new buildings and installed new equipment which will increase the present modest production of agricultural limestone to about 600 tons per 10 hour day. A small agricultural limestone plant has been operated for some time but the new equipment will increase its capacity more than five times.

In the original plant only one pulverizer was used. A second was installed when the market for agricultural lime began to expand some time ago and now three have been added, together with a 35-ton an hour dryer and storage bins, scalpers, screens and two four-unit bagging machines.

The screenings from the five crushing plants in the string of quarries which stretch for three miles, half a mile wide, along each side of the Scioto river, will be used in the agricultural lime plant, and if it is found

As was stated at the beginning of this article, the Marble Cliff quarries are among the largest operations in the country. Including the dust mill there are seven distinct plants stretched along the river, all but one of which are in operation. A large proportion of the stone is sold to the steel mills and blast furnaces for fluxing and the rest goes for road construction and concrete work. All of the quarries are connected by railroad tracks. In one place a tunnel has been blasted under a public highway to connect the main quarries. Twenty-two locomotives and about 140 cars of different types are required to handle the material in the quarries and take it from one plant to another. If quarry operations are suspended in any plant it is supplied by stone hauled from another quarry.

On the surface, along the side of one of the largest quarries, an elevated track has been constructed which ends over five great storage bins beneath which are wagon tracks. Stone is hauled by the locomotives to



General View of Marble Cliff Quarry Co.'s Plant.

that the screenings do not accumulate fast enough to keep the dust mill in operation the pulverizers will be so arranged that 3-inch stone can be used, always insuring plenty of material to keep the plant going.

The screenings are brought to the dust mill in hopper bottom cars which discharge into a pit beneath the tracks from which a short belt conveyor takes them to the dryer and by elevator to a set of scalpers and screens. The fine dust goes by conveyor to the finishing screens, the rejections into a 500-ton storage bin beneath which is located the five pulverizers. From the pulverizers it is taken by elevator to the finishing screens from which the dust flows to the bins above the loading track or is taken by belt conveyor to the big storage bin at one end of the plant, or by by-pass and trippers on the conveyors to the hoppers above the bagging machines. The equipment in the dust mill consists of one 35-ton per hour dryer, four Jeffrey Pulverizers, one Williams Mill, Jeffry elevators, two four-unit Bates Valve Bag machines and the necessary screens and scalpers.

these bins in hopper bottom cars. It is drawn from beneath to trucks or wagons for road and concrete work.

In operating the quarries, eleven steam shovels, ranging from 65 to 100 tons, eleven well drills, and thirteen air drills are used. The well drills are operated by gasoline motors in which kerosene instead of gasoline is burned. This is made possible by an invention of one of the drillers who has a device which after the motor is started with gasoline will operate on kerosene just as efficiently and at much less cost.

The crushers are most of them large size because of the fact that a large portion of the stone goes to the steel mills and is not broken as small as the regular road and building material. The different plants are designated by letters. Plant A is equipped with a No. 10 and a No. 6 crusher and produces ballast and road stone. Plant B has a No. 21 and a No. 8 and produces fluxing stone. This plant is equipped with steel storage bins. Plant C has a No. 21, No. 7½ and two No.

6's. It also has steel bins. The stone is used for fluxing and ballast. Plant D is the agricultural limestone mill previously described. Plant E has a No. 8, No. 6 and No. 5 and produces road building material. Plant F has been practically worked out and is not now operated. Plant G has a No. 8 and a No. 6 crusher. Screens and elevators are in keeping with the crusher equipment.

There is also a locomotive crane for handling material and coal from storage piles and other purposes.

One of the interesting features of the quarry management is the bonus system which has been successfully instituted by G. W. Thomas, efficiency engineer, to speed up production.

"We first made a careful estimate of what we considered the capacity of the plants under ideal conditions," explained General Superintendent J. T. Wendelken. "By ideal conditions I mean with every piece of equipment working, a full force, no shut downs—in fact, everything going at top speed. Then we offer the workmen a bonus on a fair day's production, of 75 per cent for all production over this estimate in a period of two weeks. The company takes the other 25 per cent to pay for overhead expense. You might suppose that production based on such a high estimate would leave little chance for the men to increase it and earn a bonus but this is not the case. Their monthly bonus never goes below 8 per cent and sometimes goes as high as 22 per cent. When you come to add 22 per cent to the pay envelope of an already well paid employe it is something worth working for. To help the men make this bonus the company allows them tonnage credit on plant shut downs for which they are not responsible.

"The bonus system is also applied to the drillers but they work on the basis of the number of feet drilled instead of the quarry production basis. Their extra earnings are on a par with those of the other men. We find that this system keeps the men loyal and the quarry up to the top notch of efficiency all the time."

Besides the extensive operating equipment the company also maintains a big machine shop equipped with the best machinery, including an acetylene welding plant. This saves a great deal of time, for it is quicker to mend a broken casting than to send for a new one and also cheaper. The employes are high grade men not afraid to tackle any job. For instance, when it was necessary to set up one of the big crushers they were able to use a steam shovel as a substitute for a crane in lifting and moving the heavy parts.

Open and Enclosed Dryers

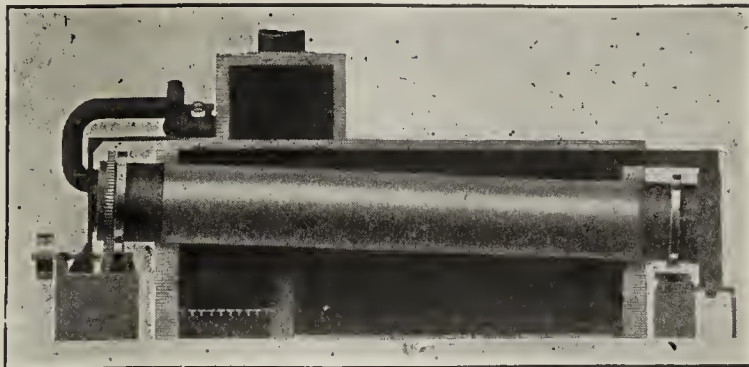
Two types of dryers made by the C. O. Bartlett & Snow Co. are being used for drying crushed limestone. This company's type M dryer consists essentially of a relatively long revolving steel shell which projects into a furnace at one end and into a breeching at the other end through which the hot furnace gases and material are passed.

The inside of this shell is fitted with a series of lifting angles which constantly elevate the material and shower it through the hot furnace gases and against the hot shell, and at the same time the material is carried forward to the discharge end of the dryer and discharged after it has been properly dried.

This type is one of the simplest and most extensively used, but it is not the most economical. A more economical type is the type D dryer. This dryer differs from the M dryer in that the shell is entirely

enclosed in a brick setting in very much the same manner that horizontal return tubular boilers are usually set.

By constructing the dryer in this manner it is possible to pass the furnace gases first around the outside of the shell and then through the inside of the shell, thus producing approximately the same effects as would be produced in a dryer of twice the length. This, it is claimed, produces a more efficient dryer which consumes less power and which is hence consid-



The Bartlett Dryer.

erably more economical. It is not so extensively used as the M dryer for agricultural limestone, since the tendency in that field has been to purchase dryers of relatively low initial cost.

New Catalog of Kent Continuous Mixers

The Kent Machine Co., Kent, Ohio, new catalog No. 9, 6 by 9 inches, contains 40 pages of pictures of and descriptive matter pertaining to Kent continuous concrete mixers. These machines are finding widening use principally because of the satisfaction given. They are continuous, automatic-measuring, in which the entire process—measuring, dry mixing, wet mixing and discharging is automatic. Hand labor is done away with except what is necessary to get the materials into the hoppers. These hoppers are of special design, the sand feeding device, for instance, being so arranged that wet sand runs with precise regularity. This is accomplished by a simple flat plate so large that practically all the sand in the hopper is directly supported by it, instead of by the hopper walls, and extends forward beneath the throat projection. In operation the hopper remains stationary, but the feed plate has a reciprocating movement carrying with it a layer of material equal to the thickness of the discharge opening, the material in the hopper following down by gravity. This feeding method is described in detail in the catalog and diagrams are shown explaining it clearly. The single-shaft, "pug-mill" type of mixing apparatus, with blades bolted to a square mixing shaft, is used. The mixing paddles are narrow and numerous, so that they chop, stir, turn and thus mix the materials both before and after the water is added. Sand and cement drop in the same place in the trough, so that the dry mixing begins immediately. More than half of the entire length of the trough is used for the dry mixing. The water supply is under the control of the operator, each spray having separate regulating valve. There is also a shut-off cock on the supply pipe so that the water may be shut off without disturbing the adjustment for the sprays. Several types of mixers are manufactured for construction and road work of all kinds.

How the Problem of Motor Transportation Will Be Solved

By R. E. Fulton

A Practical and Instructive Article on the Solution
of One of the Country's Biggest
Problems

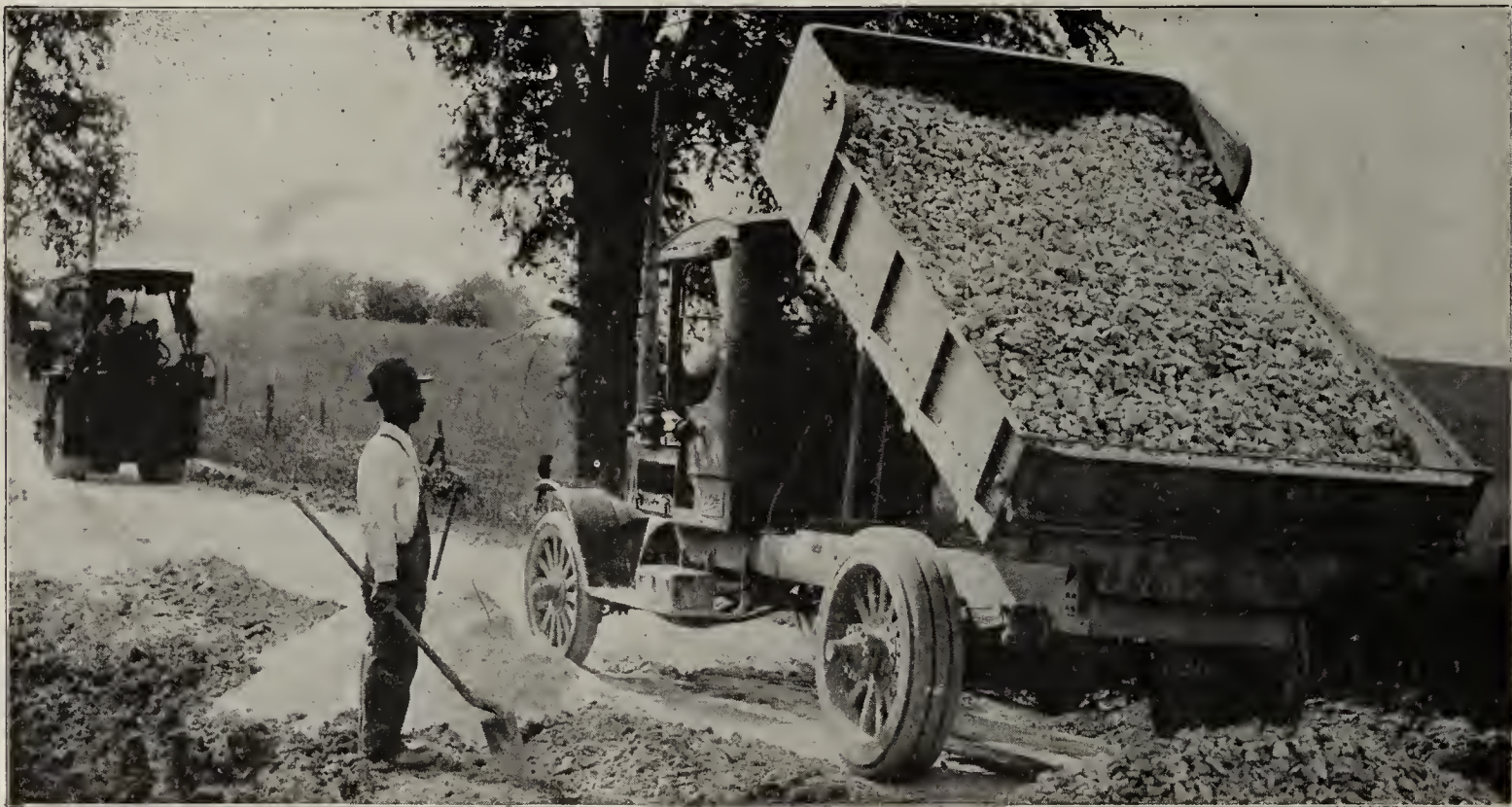
The problem of good roads is only one part of a bigger problem—transportation. It is necessary to state this obvious fact for the simple reason that the obvious is usually the last thing we see. The other half of the problem is vehicles, plus their motive power.

Good transportation has resolved itself into two things: good roads and motor trucks. A favorable sign of the times is the growing recognition on the part of good roads advocates that good roads exist for the use of better transportation media—the motor truck and the automobile.

The motor truck is not only replacing horse transportation; but in many cases it is supplanting railroads. The motor truck is the solution of the modern transportation problem.

Callan Brothers have linked their eight large warehouses, with a storage capacity of 900,000 square feet, and their motor truck service with the terminals of the canal in New York City and important upstate trans-shipment points along the canal. The Harlem river ship canal is eight miles long. Callan Brothers unload freight direct from the canal barges at their warehouses alongside their yard for shipment by their large fleet of motor trucks and delivery direct to consignees or to Callan Brothers' warehouses to be held for future delivery in New England, New Jersey, Delaware, Pennsylvania, or other seaboard states or to trans-Atlantic piers in New York City.

These motor truck transport systems are the outcome of the inability of the railroads to handle the great quantities of freight which have congested rail-



The Motor Truck Building New Roads.

In addition to the unlimited use of motor trucks for delivery purposes, they are substituting for railroads where the railroads themselves are using them to replace spurs, which are a source of expense and difficulty. Also in inter-city shipments large truck companies operate transportation service for merchandise, supplies, etc.

An idea of the extent of this form of transportation which is calling for better roads and the best motor trucks is given by the example of Callan Brothers of New York, who operate a motor truck transportation system within a radius of 400 miles of New York City. They have a fleet of over forty 7½-ton trucks. They have closely connected their service with the Erie Barge Canal which runs from Buffalo on Lake Erie across the state of New York, joining the Hudson river at Troy, a distance of 387 miles.

way traffic in all parts of the country. The condition is responsible for the discovery of the real value of the motor truck as a transportation medium. Motor trucks were used in connecting the broken lines of railroad shipping and are replacing the use of local freight trains on "short hauls" to a considerable extent, thereby releasing freight cars for the more essential shipments on longer hauls.

Shipping freight by motor trucks means less handling, less damage and safer delivery. It eliminates at least five handlings of goods as shipped by railroad: first—from factory or warehouse to freight station; second—loading from freight station or truck to cars; third—unloading at destination from cars to trucks or freight station; fourth, unloading from trucks to stores, factories or warehouses; and fifth—handling in case the goods are removed from the car to freight

station and held until the consignee sends a motor truck to remove them.

Distances considered practical for motor truck transportation are held by various authorities to average from 100 to 300 miles. In special instances trips of 400 miles have been made. An exceptional demonstration of long distance hauling is the fleet of motor trucks which the Goodyear Tire & Rubber Company operate between Akron, Ohio, and Boston for the shipment of fabrics and rubber supplies. These machines make the round trip of approximately 1,560 miles in from six to nine days, depending on the weather and road conditions. They are driven between terminals with no stops other than for meals and supplies. Each truck is manned with two drivers, one of whom drives while the other sleeps.

fuse to carry are delivered by motor trucks with but one handling after they leave the chemical works. And so on "ad infinitum."

Farmers, too, are turning to motor truck transportation. Thousands of them are now served by motor truck express lines without which they would hardly be able to ship milk or farm produce. This service has enabled them to materially increase their production, with a certainty of reaching the market. In Maryland there are twenty such lines carrying supplies into Baltimore and Washington. They have a daily capacity of 115,690 ton-miles and haul more than 500 tons a day into these markets and take back an equal amount of merchandise to farmers and country merchants. The United States Food Administration states that one man with a truck can haul as much



Motor truck hauling gravel for new roads.

The establishing of long distance motor truck service during the emergency of the war is undoubtedly the forerunner of a continuation of such service on an even larger scale in the area of peace. The service is demonstrating to manufacturers and merchants that motor truck transportation is the only way to escape delays caused by slow moving local railroad freight trains and the loss of time that had frequently been experienced even before the railroad freight congestion became so acute.

Department stores in New York City and Philadelphia are extensively patronizing long distance motor truck freight service. This method of transportation insures prompt receipt of goods.

The products carried by motor trucks have hardly any limitations. Recently several tons of finished leather, valued at \$40,000, were shipped by motor truck from Philadelphia to New York over night. Railroad service at the same time would have required from four to seven days. Machinery manufacturers and cotton and woolen mills in New England cannot well afford to await the arrival of slow incoming freights, so they have their raw materials delivered to them by motor trucks in express time. Heavy machinery is delivered direct from shops and foundries in Connecticut to factories in New York City. Wholesale grocers deliver in Washington from warehouses in Baltimore. Tons of high explosives that railroads re-

farm produce as three men with wagons and cover three times the distance.

All of this emphasizes in a general way the conditions that have obtained in railroad transportation and explains why industrial and commercial interests are turning more and more from what had been considered "short hauls" to the use of motor trucks for transportation. Business men first turned to motor truck service to meet an emergency; now they are turning to it to insure against interruptions and delays in carrying on their operations.

When counterbalanced by their capacity and more extended distance of travel, the upkeep of motor trucks has proved to be less expensive than the maintenance of horses. One of the big motor trucks of the Callan fleet has been in the service for four years, and it has never had its engine taken down for a general overhauling. It is still in commission carrying its rated capacity load every day.

The following is a schedule of the distances and time made by Callan Brothers' 7½-ton trucks:

	Miles	Hours Per Trip
New York to Philadelphia.....	100	12
New York to Baltimore.....	188	22
New York to Dover, Del.....	172	21
New York to Waterbury, Conn.....	95	11
New York to New Haven, Conn.....	77	9

New York to Bridgeport, Conn.....	58	8
New York to Hartford, Conn.....	113	16
New York to Springfield, Mass.....	139	18
New York to Worcester, Mass.....	190	23

The foregoing gives a practical insight into the transportation methods of the immediate future. Motor truck transportation has come to stay. The problem now is to perfect and develop it.

Engineers who for years have been engaged in the building of better roads are now including in their efforts the problem of better motor transportation. They realize that good roads are but a means to an end—efficient transportation, the getting of things from where they are to where they are needed in the best, quickest and most economical manner.

Within a range of 50 to 100 miles the motor truck is today easily a competitor on better than even terms with the railroads. All that is needed to widen the limits of this zone is the building of smooth, hard-surfaced highways of adequate strength. Government recognition has been taken of this fact, and a new government department is to be born out of the stress of the great war. Its purpose will be to create a country-wide system of roads that can be used in winter as well as summer. This has the double strategical value of a strictly military measure and of relieving railroads. It is now proposed that topographical maps be prepared showing out present loosely constructed and unsystematic highways. With these as a basis, a plan will be made of an interlocking system of roads, upon which the products of the nation may be moved from coast to coast, and from the Canadian border to the Gulf of Mexico. New and sounder types of roads than heretofore will have to be constructed, having as the first consideration the greatly increased wear and tear of heavy trucks. Even the best of our existing highways are not calculated to withstand continuous traction of heavy duty trucks.

The best engineering brains of the world thrashed out the problem of good construction behind the battle lines in Belgium, France and Italy. An approach to its solution was made when the engineering division of the French army "metaled" the roads behind Verdun in such speedy fashion that heavy tractors top heavy with men, munitions and supplies of all kinds, were enabled to pound over those roads day and night, thus giving the Hun a blow that led to his defeat. This lesson of Verdun has awakened highway engineers to the possibilities of auto truck transportation in times of peace as well as war.

The problem of transportation will be solved by good roads engineers and motor truck engineers working in cooperation to achieve the desired end.

A Valuable Book on Waterproofing

"Waterproofing Engineering," written and compiled by Joseph Ross, B. S., C. E., and just off the press, is announced by John Wiley & Sons, Inc., 432 4th Ave., New York City.

This book explains past and present methods of waterproofing, describes the materials, investigates their efficiency, draws helpful conclusions, and where possible, establishes standard methods and materials for general waterproofing. The value of careful study of the whole subject by engineers, especially those engaged in design is emphasized.

Summary of the table of contents is still more inviting to all who are interested in the latest develop-

ments of this very important division of building materials. The chapters are as follows:

"Need and Function of Waterproofing. System of Waterproofing. Impervious Roofing. Waterproofing Expansion Joints in Masonry. Waterproofing Materials. Waterproofing Implements and Machinery. Technical and Practical Tests on Waterproofing. Waterproofing Specifications. Practical Recipes and Special Formulas. Waterproofing Applied. Cost Data on Materials, Implements, and Labor. Practical Tables. Appendices: 1. Explanation of Mechanical Analysis for Grading Concrete Aggregates. 2. Concrete in Sea Water. 3. Report on Waterproofing—American Society for Testing Materials. 4. Glossary of Terms Used in the Waterproofing Industry. 5. References. Index."

Koehring Book of Blueprints

The Koehring Machine Co. of Milwaukee, Wis., has put into blueprint form the results of investigations made by its engineers of various methods of handling highway work of all characters and embracing haulage, central loading stations, mixer equipment, water supply, distribution of materials on the subgrade, etc. Each blueprint is 36 inches long, and should contain valuable suggestions to contractors and engineers. A most interesting type of loading station which is represented is to be built alongside of roadside elevations, enabling trucks to drive to the summit of the elevation and dump into the bins of the loading station, from which materials are fed by gravity into the batch box, by which the mixer batch is carried on trucks or cars to the mixer. Other stations are also shown, including some at railroad sidings, etc. Copies will be sent on request.

The Phosphate-Rock Industry in 1918

The phosphate-rock industry in the United States may be said to have "marked time" in 1918, for the quantity of rock sold differed only about 4 per cent from that sold in 1917. For the whole country there was a decrease in output of 93,527 tons, or 3.6 per cent, but a gain in total value of \$443,379, or 6 per cent.

The quantity of phosphate-rock marketed in 1918, according to R. W. Stone, of the United States geological survey, Department of the Interior, was 2,490,760 long tons, valued at \$8,214,463, as compared with 2,584,287 tons, valued at \$7,771,084, in 1917.

Florida land pebble constituted 80 per cent of the output of the country and the land-pebble output was 7,144 tons less in 1918 than in 1917, a slight decrease. Florida hard and soft phosphate, however, increased from 18,608 tons in 1917 to 70,383 tons in 1918, or 278 per cent. Most of this increase was made by a greater output of hard rock. The output of the state as a whole increased 44,631 tons, or 2 per cent. The statistics for Florida were compiled in co-operation with the Florida state geological survey. The output of South Carolina increased about 11 per cent, but that of Tennessee and Kentucky was 27 per cent less than in 1917. In the Western states also there was a proportionately large decrease—from 15,000 tons in 1917 to 12,000 tons in 1918, or about 20 per cent.

The failure of the industry to make a greater output was due largely, it is believed, to the shortage of labor caused by the war.

An Unusual Concrete Highway Bridge

By C. S. Bennett

A highway bridge has been built near Greenup, Ky., having a total length of two hundred feet, which is of a type not usually employed for a structure of such length on a county highway. Results, however, seem to have justified the use of this type in this particular instance.

The bridge spans a ravine and a small creek on the state highway along the Ohio river. Funds for building a structure at this point were limited, and a careful study was made of various types of structures in order to select one which would combine utility and durability at a minimum cost. A fill with a culvert was considered, as well as several types of long span bridges, but the state highway department finally designed and decided upon this structure, which seemed to be more economical than any other.

The bridge consists of eight spans, each twenty-two feet in the clear, supported by open bents varying in height from a maximum of 35 feet from solid rock to

cross beams are three feet by one and a half feet in section and reinforced with twelve $\frac{1}{2}$ -inch rods. The abutments were constructed of plain concrete and in form of the common U type.

As special forms had to be built for this structure, the work was carried ahead one span at a time, two sets of forms being used. The contractor was able to use the bents of the original structure in securing support for the forms for the superstructure. Owing to the unusual amount of steel used in the design, the forms were braced very thoroughly. Forms were built with a camber of one inch to allow for sag when the concrete was poured. The amount of sag was measured for each span and the maximum sag was $\frac{3}{4}$ inch.

After the completion of the concrete work, the roadway was surfaced with waterbound slag macadam on an earth cushion.

The quantities of material used in this bridge were:



Town Branch Concrete Bridge, Greenup County, Kentucky.

the under side of the floor beams to a minimum of about 29 feet, although only about 15 feet of the latter extends above the ground surface. Each span consists of four girders connected by an eight-inch floor slab combined in T-beam construction. The general design was originally prepared for single-span bridges with a loading condition equivalent to a twenty-ton road roller, but the design was readily adapted to the combination of eight such spans into this single structure, special expansion joints being introduced at alternate spans, these joints extending through the hand-rail and post as well as the floor system.

The supporting structure consisted of two abutments and seven open bents, each bent consisting of two legs tied together by a cap beam at the top and a cross beam at a point eleven and a half feet below the bottom of the cap beam. Each post or leg is of rectangular section two feet by three feet and reinforced with twenty $\frac{3}{8}$ -inch square deformed rods, with quarter-inch hooping every twelve inches. The bottom of each post was carried twelve inches into the solid rock, without the use of spread-footings, and five-foot anchor rods one inch in diameter were set two feet into the bed rock.

The cap beams were so designed that all of the girders carrying the floor had firm support. Expansion joints were provided between the floor beams and the cap beams. The cap beams are three feet by three and a half feet and are heavily reinforced. The

Gravel, 620 tons; sand, 255 tons; cement, 509 bbls.; steel, 45,550 lbs.

The total cost of the finished structure was \$7,420, including the surfacing of the roadway. The bridge was built by Burgess Brothers, of Scottsville, Va., under direction of the Department of Public Roads of Kentucky. The writer was resident engineer for the state.

Concrete Pipe

The city council of Eau Claire, Wis., has advertised for bids for the construction of a 36-inch concrete pipe leading from the wells to the Chippewa river. This will replace a 26-inch wooden pipe the water works plant was originally built. This wooden pipe has given good service, but is becoming defective and has had to be repaired several times during the past year and as the entire water supply of the city passes through it, it has been decided to replace it with concrete pipe 36 inches in diameter which will have twice the capacity of the wooden pipe and will amply provide for the needs of the city.

The flow of water through this pipe is entirely a gravity proposition and is subject to no pressure and a concrete pipe will answer the purpose as well as an iron pipe and the cost will approximate only one-third as much, it is pointed out.

The length of the pipe to be laid is 2,160 feet and will be installed under the supervision of City Engineer Gar-nock.

Methods of Blasting and Explosives to Use

There are five general methods of blasting in quarries as follows:

1. Breaking boulders or large blocks.
2. Blasting single holes.
3. Bench shots of a row of holes.
4. Full face blasts of large holes.
5. Blasting of tunnels or coyote holes and other special methods.

Some particular explosives are especially suited to these various methods, and it is the idea of this article to tell what they are and also to explain the best way to use them to get the most satisfactory results.

Boulder Blasting

This is done in two ways: 1st, by mud capping, blistering, or bulldozing as it is called in various places; 2d, by block or plug-holing.

Mud capping consists of placing a few sticks of high explosive on the surface of a large rock and covering it with clay or mud. The dynamite is pressed closely against the rock and is usually shot with a few feet of fuse and a cap placed in it.

Block holing is done by drilling a small hole to the center of the rock and tamping a small charge of high explosive with a fuse and cap into the bottom of the hole. The holes should be stemmed full of clay.

The latter is the most efficient way of using a high explosive to break up rock and the former is the most inefficient way. It is often advisable and necessary to mud cap so as to save time. The explosives that give the best results in the former are Straight dynamite or Red Cross Straight 40% to 60%, as they are the quickest. The Red Cross is low-freezing and eliminates considerable thawing trouble. Some of the non-freezing explosives like Arctic (Nitro-Starch) and Monobel (Ammonia) powders are used for this purpose but are not as efficient as Straight dynamite.

For block holing, Red Cross Straight or Straight dynamite are used and also Red Cross Extra, Arctic and Monobel. Du Pont Gelatine is used also at times. 40% to 60% strengths are used as a rule. Nothing less than a No. 6 cap should be used with any of these explosives.

Blasting Single Holes

This is done where, because of irregular condition of the rock, no one method of blasting is used. These holes are placed in some advantageous position either with a hand drill, hammer drill, tripod machine or a well drill. Where the hole has a heavy burden it is sprung or chambered by exploding various sized charges of a high explosive in the bottom. This makes a cavity or chamber in the bottom of the hole, in which

a large charge of black powder, Judson R. R. P. or high explosive can be loaded. Any high explosive may be used and exploded with an electric blasting cap. Where black powder or Judson R. R. P. is used it is necessary to use a primer charge of a 40% or 60% dynamite, and an electric blasting cap. In these large charges at least two electric exploders should be used, and No. 8 is the most economical.

It is very difficult to make a chamber of a particular desired size or to determine what size has been produced, so this makes the loading of these holes uncertain. Care must be used to see that the hole has time to cool before it is reloaded or accidents may occur. The final charge should not be put in until the day after the springing has been completed.

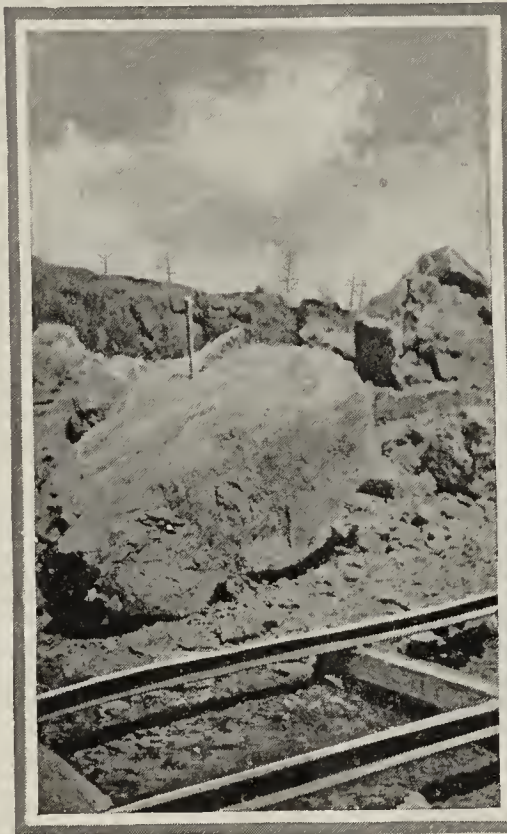
Where the holes are dry, quarry powder, Arctic or Monobel, may be used or even black powder or Judson R. R. P. if they are strong enough. If the holes are wet Red Cross dynamites may be used, unless the holes contain much water, in which case it is necessary to use a gelatine dynamite. The strength necessary depends of course upon the hardness of the material and the fragmentation desired and can be determined only by experience or trial. Sometimes two kinds of explosives are used in the same hole, but this should be done only on competent advice, and for some special reason.

Bench Blasts

This consists of a row of holes drilled in any direction, but all practically parallel, and exploded simultaneously with electrical exploders or Cordau Bickford detonating fuse. They are usually about 1½ inches to 3½ inches in diameter and not over 25 feet in depth. As a rule these holes are drilled perpendicular to the rock strata, although in some cases, such as toe holes, they may have no relation to the layers of the rock. Bench blasts are a very economical

way of breaking up the rock as the explosive is well distributed throughout the mass. It is the rock which is near the explosive that is well broken in any case. Where the dip of the strata is toward the face, these bench shots break up the rock as well as displace it in the one operation.

If the holes are wet, they are usually loaded with Du Pont Gelatine Dynamite, but if dry, Du Pont Red Cross Straight or Extra or Quarry Powder or Arctic or Monobel can be used to advantage. The holes are usually filled one-half or two-thirds full of explosive and the hole should be stemmed with clay for a depth equal to the burden at the top. At least one No. 6 electric blasting cap should be used in each hole, and if the powder charge is over five feet long there should



Boulder Before Block Hole Shot.



Effect of Block Hole Shot.

be one additional exploder for each five feet of the charge. For Gelatine or Arctic or Monobel it pays to use either a No. 8 detonator, or better still, a primer of Red Cross Straight 60 per cent Dynamite to explode charges. The size of explosive used should be about one-eighth inch less than the size of the bottom of the hole. The strength necessary can be determined only by experience, judgment or trial. In very wet holes waterproof electric blasting caps should be used.

It is sometimes necessary to spring these holes in order to get in a sufficient amount of explosive to break up the rock. This should not be done, however, unless absolutely necessary, as springing is uncertain, takes more time and often makes it difficult to load the hole. In fact, it often spoils the holes.

Face Drafts—Well Drill Holes

In large quarries where the top is fairly level and the over-burden not too great, it is often possible, by means of a well drill, to drill holes from the top to the bottom of the quarry and blast several of them simultaneously to produce a large amount of broken rock. These holes are usually about six inches in diameter, from 15 to 30 feet back from the face and from 15 to 40 feet apart. They should extend from 2 to 10 feet below floor of quarry. The face of the quarry should be practically vertical. In some cases where it is desired to break up the rock, several rows of holes are drilled staggering and fired together. This method of drilling and blasting is used chiefly in large limestone quarries, and in others where this type of drill can be used satisfactorily. The cost of drilling the holes runs from fifty cents to \$2.00 per foot. If it costs any more than this to drill the rock, the system will probably not be economical. The most satisfactory height of face is from 50 to 150 feet, although it is possible to use this method on smaller or greater heights of face. The spacing of the holes must be determined for each quarry, as it depends upon the kind of rock, the natural conditions and size to which it is desired to break the rock.

The explosive used in blasting these holes depends also upon the rock and its conditions and the desired results. If the holes are wet, gelatine dynamite is usually used at least in the bottom of the holes. For maximum fragmentation Straight 60 per cent or Red Cross Straight dynamites are often used, but are not recommended, because of their sensitiveness to shock, heat and friction. The Extra or Red Cross Extra dynamites are often used in fairly dry work. Where the holes are dry it is possible to use Monobel (a Nitrate of Ammonia powder) or Arctic (a Nitro-Starch explosive). These explosives are insensitive to shock. As the Monobel is difficult to ignite by heat or friction it is the safest to use. For medium hard rock a special explosive manufactured for this purpose called Quarry Powder is often very economical and satisfactory.

If these holes are exploded by electric blasting caps it is usual to use a Red Cross Straight 60 per cent primer and a No. 8 cap to produce the best results, and there should be at least two of these in the charge. One is placed near the bottom and one near the top, and in very long charges, one in the middle. The most satisfactory method at this time is to use a line of Detonating Fuse or Cordeau Bickford for the full length of the hole. This is exploded either by means of a trunk line of Cordeau along the top of the holes, or preferably by an electric blasting cap, placed at the top of each line of Cordeau.

The amount of explosives necessary, and the strength required as well as the kind that will produce

the best results, can be determined only by judgment and experience. Sometimes it is necessary to try out two or three kinds to determine which is the most efficient and satisfactory. The holes are usually loaded with explosives for about two-thirds of their depth, and sometimes it is necessary to split the charge with several feet of tamping material. The depth of tamping in the top of the hole should be at least as great as the burden in front of it. Sometimes for special reasons it is best to use more than one kind of explosive in the holes, but this should be done only on competent advice. The high explosives are packed in 4x8 and 5x8-inch cartridges for use in well drill holes.

Concerning Lime

A significant conference occurs next week at Cornell University, Ithaca, N. Y. Approximately one hundred sales managers of fertilizer manufacturing concerns in the northeast will meet there for the purpose of considering the various problems confronting the fertilizer industry and for the further purpose of stimulating the demand for this material. Professor Fippin appears several times upon the program, one of his addresses being on the subject "Lime in Its Relationship to Fertilizer Use."

Inasmuch as it is well recognized not only by agronomists generally but by the fertilizer manufacturers themselves, that fertilizer alone cannot produce the best results, but that it must be used with lime to secure its full benefit, it is evident that this conference will be productive of much good for the lime industry. It is extremely gratifying that such a close and satisfactory contact with the fertilizer industry is thus established through Professor Fippin, the director of the agricultural bureau of the lime association.

The Utah Lime and Stone Company, Salt Lake City, Utah, is in need of a general superintendent. They would like someone who has had considerable experience burning and hydrating both dolomite and high calcium lime, a man who has sufficient technical knowledge to make chemical determinations in the laboratory, spending an hour or so a day at this work.

Their plant seems to be located so as to offer good possibilities for a man who can run the plant successfully and build up the business. If any of our readers know of any young man who will measure up to the requirements of a general superintendent, Mr. W. E. Ellerbeck, vice president of the Utah Lime and Stone Company, Salt Lake City, will be pleased to have the information. Mr. Ellerbeck states there is a good opportunity for the right man.

Latest Catalog of Griffin Mill and Bradley Hercules Mill

The Bradley Pulverizer Company of Allentown, Pa., are sending to the trade their latest catalogue descriptive of the Griffin Mill and Bradley Hercules Mill.

These catalogues are descriptive of fine grinding and semi-fine grinding machines for use in cement mills, agricultural limestone plants and fertilizer works. They comprise a very complete line of pulverizing machinery, being descriptive of the latest improvements in these machines, the outputs ranging from two to fifty tons per hour.

Construction of Concrete Pavements *

By J. L. Harrison

The growing popularity of the concrete pavement and the many contradictory statements which are made in regard to the proper methods of its construction lead the writer to enter a word of caution at this time, for, while there are many who seem to assume that anyone can lay good concrete, it is a fact that comparatively few do lay good concrete for the simple reason that certain of the most elementary details of good concrete construction were so often overlooked.

In the first place, concrete is a mixture of aggregate, water and cement, and the first mistakes made in securing good concrete are apt to be made in selecting

aggregate, which must be filled by the particles of fine aggregate. In fact, the ordinary specifications for concrete work, including concrete roads, make no variation in the maximum size of the sand particles whether the coarse aggregate must all pass a 1-inch screen and be retained on a $\frac{1}{2}$ -inch screen; or whether it must all pass a $2\frac{1}{2}$ -inch screen and must all be retained on a $1\frac{1}{2}$ -inch screen; or whether it must all pass a $2\frac{1}{2}$ -inch screen and must all be retained on a $\frac{1}{2}$ -inch screen; though it is patent that the actual size of the spaces between the stones—the spaces which the sand is supposed to fill—will be very different in these different cases.



Concrete Road between Monroeville and Norwalk, Ohio

the aggregate. Unfortunate as this may seem, there is, at present, no well-recognized method by which the manner in which any sand will act in combination with any given stone can be determined except by actually testing them together in the laboratory.

This is unfortunate, but beyond dispute, and the engineer who endeavors to select the sand for a concrete job, though he test it in conformity with the best practice laid down by the largest engineering societies in this country, is in no way thereby insured that it will make good concrete, when combined with the stone which he intends to use. This is due, of course, to the fact that specifications for both coarse and fine aggregate determine the grading of the particles only within very wide limits, and so offer no indication as to the size of the voids in the coarse

In fact, it is not putting it too strong to say that the sand which shows the best breaking strength when used in briquettes should be looked on with extreme suspicion as a concrete sand, for it is apt to be too coarse for use with any but the largest sizes of broken stone. The writer has in mind a fine aggregate composed of crushed limestone which he once had tested and which ran well over 350 pounds in the 1-3 mortar test. But it was an absolute failure as a sand when mixed with 1-inch stone, and nothing at all could be done with it until the mix was so recalculated on the basis of the Fuller curves which show that, for practical purposes, the fine aggregate should be considered as that part of the total aggregate which is less than one-tenth of the diameter of the coarsest particles in the coarse aggregate.

The sand in question ran 45 per cent of particles between $\frac{1}{4}$ -inch and $\frac{1}{10}$ -inch. A 1:2:4 mixture was

*Written for The Road-Maker.

required by the specifications. To get two parts of aggregate less than $\frac{1}{10}$ -inch it was necessary, therefore, to recompute the mix and to use 2 parts of the finer material in order to obtain what was, in reality, one part of fine aggregate. As a result, it worked out that the proper mixture for these materials was practically 1:4:2, though it should be borne in mind that the fine aggregate, as originally provided for this work, passed the customary specification for sand and passed the mortar test with a showing of strength much above the average.

This illustration admittedly deals with an extreme case, but nevertheless should serve to show that independent tests of fine and coarse aggregate are just about valueless in determining the probable strength of ordinary combinations of these aggregates in concrete, and the engineer who wishes to secure good concrete roads will, therefore, buy the aggregates for such roads only after careful and thorough tests as to the strength of the concrete which can be produced from these materials.

Nor should these tests be confined to one mixture. The use of too much mortar is a weakness in much concrete now constructed, and not a few concrete roads show a surplusage of $\frac{1}{4}$ -inch or more of mortar over the whole surface. This mortar is not as strong as the concrete itself should be and its presence could have been avoided by using a properly proportioned mix.

When samples of aggregate are sent to a laboratory for test they should not, therefore, be tested on the assumption that a 1:2:4 mix or 1:1½:3 mix will be used, but should be sent to the laboratory with a statement that 4½:5:5½, or 6 parts of aggregate are to be used with 1 part of cement, and that the laboratory must determine the proper relation of the coarse and fine aggregate. Thus, if 5 parts of aggregate are to be used the laboratory should determine whether the mix ought to be 1:2:3, 1:1¾:3¼, or 1:1½:3½. It is more than likely, especially if gravel is to be used, that the 1:1½:3½ mix will be the strongest as well as the cheapest, but there is no reason for being at all in doubt about such a question, as this is one which any good laboratory can determine at small cost.

Some engineers prefer to specify the mortar and leave the determination of the amount of stone to the laboratory. Thus, with a given sand, if it has been determined that a 1:1½ mortar will be used, the laboratory is asked to determine whether 2¾, 3, 3¼, or 3½ parts of a given stone would produce the best concrete under ordinary field conditions. This method is, however, open to the objection that if the maximum size of stone is small and there is a considerable percentage of coarse material in the sand, the laboratory cannot readily correct for it. Thus, suppose that graded coarse 1½-inch aggregate is to be used, and that the sand contained 25 per cent of particles which are retained on a ⅛-inch screen, it would very possibly develop that in order to obtain a real 1:1½ mortar 2 parts of sand would have to be used with each part of cement. If, then, the stone was low in voids, it might very easily happen that 3½ parts of stone would be needed to take up the mortar produced by the 1:2 mix, in which case the mixing order should read 1:2:3, and the resulting concrete would actually be a 1:1½:3½ concrete. But if such a problem as this is sent to a laboratory with the request for a determination of how much stone should be used in concrete in which this sand is to be used in 1:1½ mortar, the result would be to obtain instructions to use a mix approximating

1:1½:2¾, which would not be what was really wanted, but a richer and a more expensive mix.

The next matter which deserves attention is the amount of water to be used. Excess water cuts down the strength of concrete at a fearful rate. In fact, it is very easy to throw away half or two-thirds of the possible strength of concrete by using too much water in mixing it. The use of excess water is usually defended by a pretense that a proper percentage of water will not give a concrete which can be worked into shape back of the mixer. There is absolutely nothing to this. It does require a little more work to handle concrete which contains only the proper percentage of water, and it does require a little more care in distributing it over the subgrade in dumping it, but that concrete containing a proper amount of water can not be handled is the most ridiculous nonsense, and the propaganda of such nonsense is at the basis of most of the poor concrete road work which is to be found in this country.

The twin brother of excess water is under mixing. In fact, excess water is often used to cover up under mixing. Recently, in discussing this matter with a man in charge of a good deal of concrete highway construction, objection was raised to the writer's suggestion that better concrete could be secured by increasing the there prevailing mixing period of one-half minute, on the ground that "repeated efforts to increase the length of time in the mixer only served to mix the water all out of the concrete." The writer wonders how many engineers really have the idea that it is possible to remove any water in this way which is of any value in the mix. As a matter of fact, this man was right in one particular at least. If too much water has been used in a batch, a proper amount of mixing will separate it—there can be no doubt of that—but the remedy is not less mixing, but less water.

There seems to be some misunderstanding of the reason for long mixing. In the first place, when the stone and the sand are placed in a mixer with the cement and water, the individual bits of sand and the pieces of coarse aggregate are usually—practically always, in fact—more or less covered with minute particles of dust. The sand is also apt to be more or less coated. A microscope will reveal this when the unaided eye will pass these materials as clean. Washing will remove this material only very slowly, if at all, and so it must be ground off in the mixer. The principle is very much the same as that involved in placing a patch on a rubber tire. The surface material may be sound, etc., but cement will not stick to it properly until the dirt on the surface has been cut away and the clean rubber exposed. The grinding action in the mixer cuts through the films of whatever nature they may be, which cover the surface of all particles of aggregate and permits a strong attachment between the cement and the stone.

A second reason for long mixing is to be found in the fact that, when the mixer is only turned a few times and the batch dumped out, a good deal of the water actually exists in the form of globules. Water occupies space in the mixture just as sand and stone do, and when it is not properly distributed by mixing, the concrete in which it is placed will be visibly porous. Undermixed concrete takes more water than properly mixed concrete, because it takes quite a little mixing to break up these globules and spread the water in them through the mix as a thin film covering every particle of cement and aggregate. If this process of wetting the surface of every particle of cement and

aggregate were instantaneous, much less mixing would be necessary; but the water film must supplant the air films on the surface of the grains of cement and on the aggregate, and in order to make the substitution complete, time and a good deal of rubbing are necessary.

In short, undermixed concrete is weak, because it contains too much water in the form of minute globules, because the surfaces of the particles of aggregate have not been rubbed clean, and because there is not a proper contact between the water film and the particles of cement and aggregate. Nor can these matters be corrected by any simpler process than by ample mixing. For that reason concrete for pavement purposes should be mixed for 2 minutes or more and it is an open question whether it would not be enough better to justify the added cost of mixing it 3 minutes.

At first glance it will seem that a batch every 2 minutes will reduce the output per day. In some cases this may be true, but a batch every 2 minutes is 30 batches an hour, or 240 batches during an 8-hour day. If a half yard mixer is being used, this will provide for 120 yards of concrete pavement 18 feet wide and 6 inches thick every day, which is less than many contractors attain, but more than contractors usually average. Moreover, it should be kept in mind that concrete so mixed will be worth all of any extra cost chargeable to the extension of the period of mixing.

Last, but not least, it should be emphasized that no sort of finishing can possibly take the place of proper mixing and placing. Just now the roller is the fad. Six months from now it may be something else. The roller is a good tool for the finishing of a concrete road, but it will not correct poor proportioning, over watering, or under mixing. At present many engineers seem to be using it under the impression that it will remove excess water and so correct the faults which arise from the use of excess water. The roller does draw off some excess water—but why put in the excess water? Why not mix the concrete right in the first place? It can be mixed right, for the state engineers at Sacramento and in other places do mix it right—and with no apparent added cost. Why, then, put excess water enough in the whole of a 6-inch pavement to reduce the strength of the concrete 50 per cent or more and rush it through the mixer in a quarter of the time it needs there, and slap it onto the road and then try to take part of the excess water out of the top inch with a roller?

The roller is a good finishing tool. It makes a nice surface, and its use is entirely justifiable—but engineers should not use it as anything but a finishing tool. If good concrete roads are to be secured they must still be secured by observing first principles in the selection of materials and in proportioning, mixing, and placing the concrete. Good finishing is very desirable, and a roller will help to secure a good finish. But good concrete is a much more important matter and no roller will make a good pavement out of poor concrete.

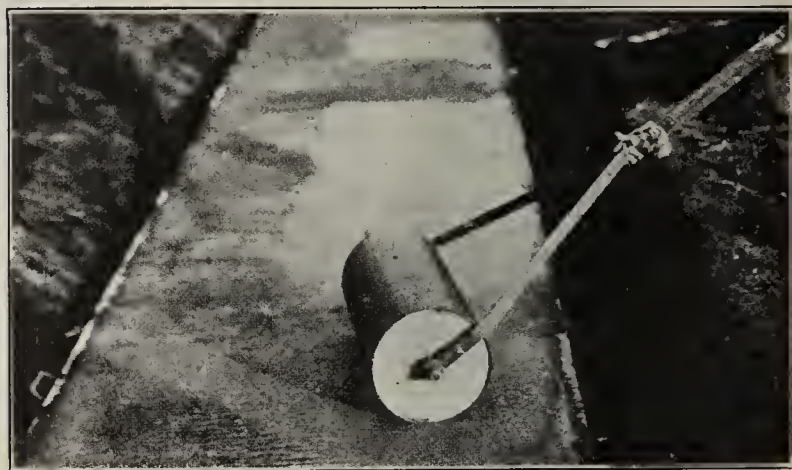
One-Course Sidewalks Finished with Paving Roller, at Beloit, Wis.

That the advantages of one-course sidewalk construction are being recognized is shown by the fact that such walks have been successful in many places, among which may be mentioned Bozeman, Mont.; Columbus, Ohio; Dardanelle, Ark.; Kirksville and St. Joseph, Mo.; Donora, Pa.; Yorkship Village, N. J.;

Walla Walla and Garfield, Wash., and Hammond, Ind. In practically all cases these are giving better satisfaction than the usual two-course construction. It is recommended that a mixer not leaner than 1:2:4 be used and that the minimum thickness of slabs be 4 inches.

One-course sidewalks finished with a roller were recently laid in the subdivision of the Eclipse Home Makers, Beloit, Wis. These walks consisted of slabs about 30 feet long, 4 inches thick, with $\frac{1}{4}$ -inch joint filler every 30 feet. Joints were defined on the surface in the usual manner for the sake of appearance.

Coarse aggregate in this work ranged from $\frac{1}{4}$ -inch to 2 inches. An attempt was made to use the regular paving roller but was unsuccessful because the walks were only 4 feet wide. This difficulty was solved by building a roller $2\frac{1}{2}$ feet long and 11 inches in diameter, which forced the particles of large aggregate



Special roller of the paving type being used to finish one-course concrete sidewalk at Beloit, Wis.

away from the surface and brought $\frac{1}{2}$ inch of mortar to the top for final finishing. Instead of striking the concrete off even with the side forms, the strikeboard was raised about $\frac{1}{4}$ inch by nailing strips on its edges and the contour of the walk left slightly above the forms and later brought even with them by rolling. Labor cost of placing this walk proved to be less than for a two-course walk because the usual methods of construction were considerably simplified by this practice.

Shope Concrete Brick Plants Enlarge to Meet Demands

The Shope concrete brick manufacturing plants at Seattle and Walla Walla, Wash., have been enlarged to care for the increased demand for this brick.

Sanders Bros. and Ingalls, proprietors of the Walla Walla plant, received orders recently for some of the large buildings to be built in that city and vicinity. The greatest demand appears to be for the cream colored brick which has become popular throughout the Northwest.

They secured an order for 125,000 of these brick to be used in the college buildings to be built at Walla Walla and will also supply all the brick to be used in a bank building to be built near Walla Walla.

The Seattle plant, manufacturing the Shope concrete brick, found it necessary to move to a tide water site permitting them to handle their materials and finished products more expeditiously.

Brick manufactured by the Shope Brick Company are made of cement by patented processes. They are impervious to moisture and gain in strength instead of

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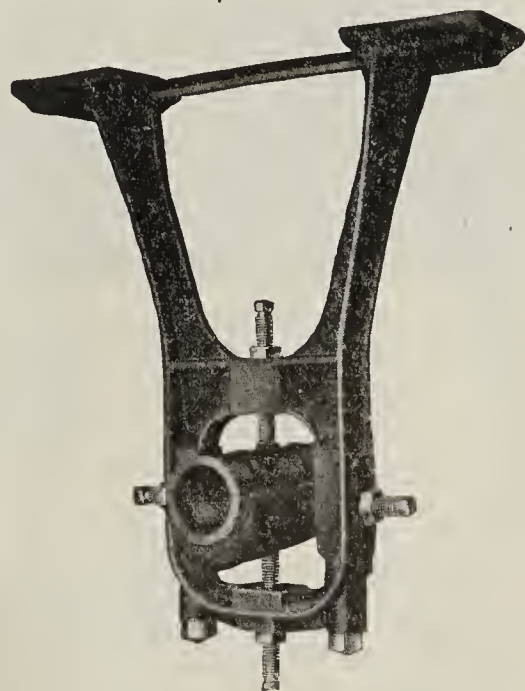
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deteriorating with age. The bricks may be made in colors and designs to suit the taste of the builder and are adaptable to a wide variety of uses.

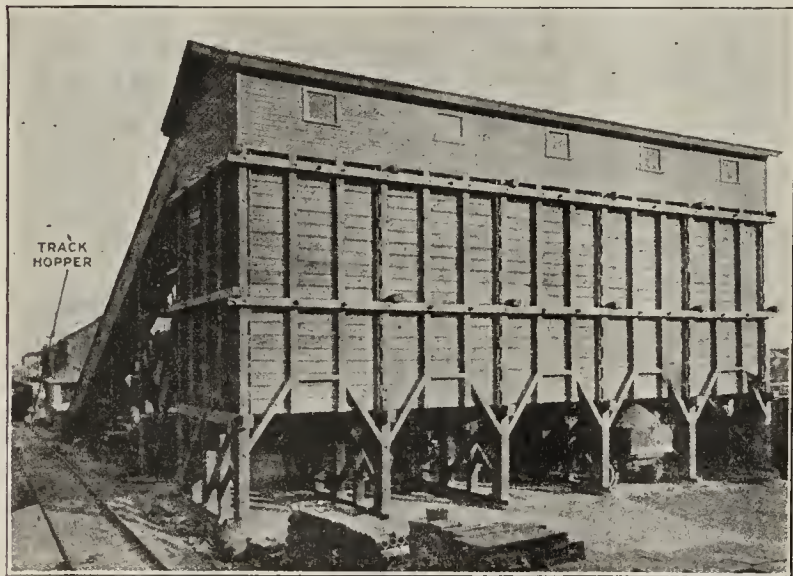
The Shope Brick Company has been in business in Portland, Oregon, for over eight years and their products have been used in the construction of many large apartment houses and business blocks in Northwestern cities. The company recently purchased a half block adjacent to the Southern Pacific tracks at East Eighth and Division streets, Portland, Ore., and will install equipment for the manufacture of their products at that location.

Architects and builders generally indorse the use of Shope brick for residence construction and predict a wide use of this material when its merits become better understood.

Retail Material Handling Plant

The Chicago and Oak Park Supply Company is operating a unique material handling plant at Oak Park, Illinois. The property is wedge shaped, the short side being about 90 feet and extends 600 feet along the railroad track. To facilitate traffic in the yard, the storage bins were built across the lot permitting five trucks to load at the same time, while passing underneath the bins. All teams and trucks enter from the west end of the property and leave at the point or east end after passing over a weighing scale.

A 40-foot by 14-foot track hopper is located about the center of the yard which allows seven cars to be placed above the hopper on a slight upgrade. As the cars are dumped, the loads are towed down to the hopper by means of a car puller driven from the conveyor motor. Directly below the track hopper are three 24-inch steel apron feeders. These feeders discharge onto an 18-inch steel apron conveyor running parallel to the tract at a greater speed than the feeders and discharging to the foot of an 18-inch inclined belt con-



General view of the plant, showing inclined conveyor gallery and storage bins, and chutes for loading motor trucks.

veyor. This belt conveyor travels 250 feet per minute up an incline of 18 degrees discharging the material onto a horizontal 18-inch belt conveyor equipped with a self-propelling tripper which distributes the material into any desired compartment.

The five-compartment bin has a storage capacity of 800 cubic yards for crushed stone, torpedo and sand, and fitted with 15x15-inch steel clam-shell gates set flush with the bottom to give extra road clearance.

The machinery has an unloading capacity of about

15 cars per day and requires but 15 horse power to operate, three 220 volt 60 cycle 3 phase induction motors are used.

The plant is efficient and economical to operate as it dispenses with all but two or three men and reduces the loading time for seven-ton trucks to ten seconds.

Scaife Opens Chicago Office

Wm. B. Scaife & Sons Company of Pittsburgh announces the opening on July 1, of a Chicago sales and engineering office at 38 South Dearborn street, with Charles F. O'Hagan, formerly chief engineer of the company at Pittsburgh, as resident engineer and manager.

This company is the oldest manufacturing concern west of the Allegheny mountains. During the more than one hundred years since their business was founded, they have from time to time as conditions arose, added to their manufacturing facilities. They now manufacture black or galvanized, riveted, brazed or welded steel tanks for air, gas and liquids, steel shipping drums, range boilers, steel structures, also the well known We-Fu-Go and Scaife water softeners and filtering equipment.

Huge Single-Roll Crusher

A single-roll rock crusher of the Fairmount type, weighing 225 tons, made by the Allis-Chalmers Manufacturing Co., has been installed at the limestone quarry of the Michigan Alkali Co., at Alpena, Mich. This particular installation is the largest of this type to date. The crushing roll is horizontal, as shown, and is provided with projecting teeth in staggered rows upon the face. The crushing is done against an anvil plate, built up in vertical sections. These sections are hollow steel castings, strung upon a shaft and having the lower or jaw ends carried by a cross-beam which is held by diagonal anchor bolts, as shown. Heavy springs on the ends of these bolts allow the jaw to give slightly under excessive pressure and so prevent breakage. The roll on the Alpena crusher has a cast-steel shell $7\frac{1}{2}$ inches thick, with teeth of manganese steel keyed in slots. This shell is keyed upon a cast-iron spider, which in turn is keyed to a heat-treated steel shaft 20 inches in diameter at the bearings. On the shaft is a $175\frac{1}{2}$ -inch gear wheel, driven by a 34-inch pinion on a countershaft carrying a 10-foot belt pulley with 37-inch face. This is belted to a 250 horsepower motor, the distance between motor shaft and pinion shaft being about 18 feet. The motor runs at 580 r.p.m., the pinion at 120 r.p.m., and the crushing roll at 23 r.p.m. The machine is mounted on a massive concrete base.

The main part of the hopper is of cast steel, 7x12 feet at the top. Above this is a structural-steel hopper into which the rock is dumped from standard-gage quarry cars, which are of 12 to 14 tons capacity. Rocks 5x7 feet can be handled. The crusher is adjusted for a 7-inch product and delivers about 7,000 tons of broken stone per 10-hour shift.

The two principal points in which the Fairmount crusher differs from earlier roll-type crushers are (1) the use of an anvil gradually approaching and extending under the roll, and (2) the use of a roll having part of the knobs or studs higher than the regular ones. The first feature increases the size of the opening where the stone is crushed against the anvil plate. In regard to the large or slugger knobs, it has been found that with knobs of uniform height the crusher is not



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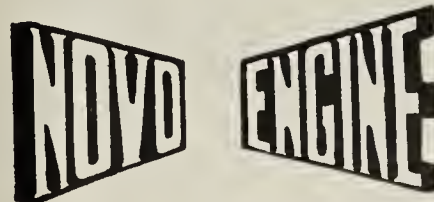
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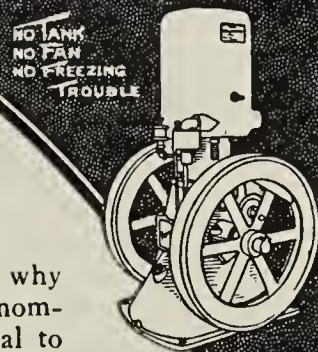
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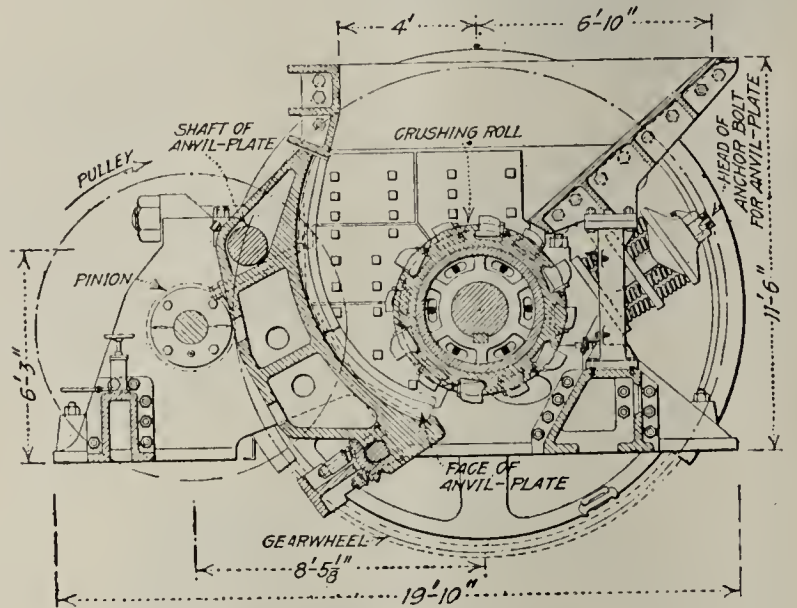
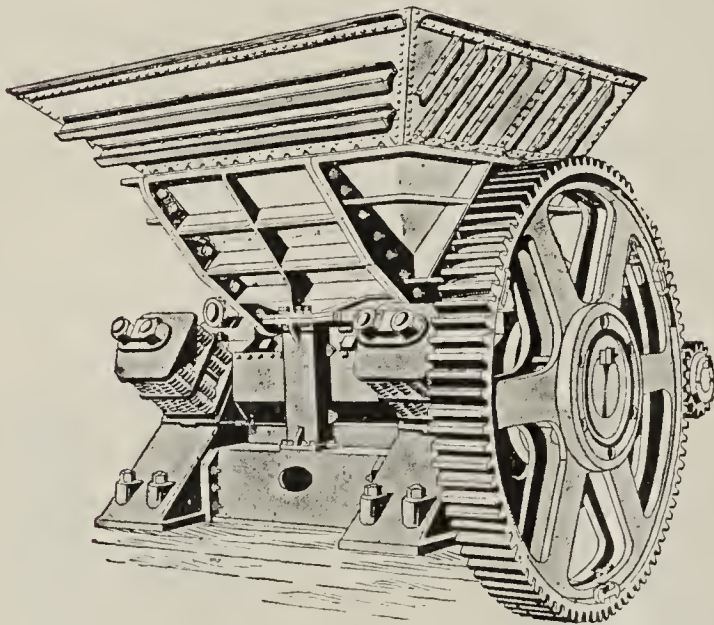
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suitable for breaking large stone. This was discovered on the original machine. It was verified recently, to settle a dispute, by fitting a roll with knobs of uniform size. This would do very good work on small pieces of stone which could be gripped between the roll and the anvil, but large blocks of stone were not crushed at all, and it was necessary to shut down the crusher and lift them out.

The first crushers of this type were installed in 1911 at the plant of the Casparis Stone Co., at Fairmount, Ill., where two of the machines were started in 1912. It is stated that single-roll crushers had been used prior to that time for crushing the smaller size of stone loaded by hand. They were not suitable for crushing the large-sized rock loaded by steam-shovels, however, as the opening between the roll and the concave breaker plate was not sufficient to allow large pieces of stone to be gripped, and no provision was made for sledging the stone on top of the roll.

The crusher is placed in a building on the floor of the quarry, the center line of the roll being about 45 feet below the ground. A cable incline with two balanced 8-ton skips delivers the stone to a rotary screen

lapsible steel forms effects a great saving. "Hipco" Culvert Cores, made by the Highway Iron Products Co., Ligonier, Ind., are very reasonable in cost. They are adapted to construction of culverts 18 to 48 inches in diameter and 16 to 24 feet in length, and are quickly adjustable to the different sizes. They are made of galvanized steel, light and easily handled, and so simple that anyone can operate them, setting up or knocking down the core in a few minutes. It is claimed



TWO VIEWS AND SECTION OF ALPENA ROLLER ROCK CRUSHER

above an elevated storage bin on the surface. The paved chute from the crusher to the loading pit of the skips is closed by motor-operated sliding doors parallel with the incline. These are operated automatically by means of tripping levers on the skips.

This machine was designed under the direction of R. C. Newhouse, engineer of the crushing and cement machinery department of the Allis-Chalmers Company.

Collapsible Culvert Forms

Eventually all culverts, it is safe to say, will be built of reinforced concrete, for this is the type of construction that combines greatest economy with greatest permanence. Wood culverts are only temporary, and a constant source of expense for maintenance. Corrugated metal culverts rust away in time. Stone culverts, rightly built, last indefinitely, but are very costly; and the same may be said of vitrified brick culverts. The concrete culvert is a saving investment at the start, and an everlasting source of satisfaction.

On concrete work, the use of adjustable and col-

lapsible steel forms effects a great saving. "Hipco" Culvert Cores, made by the Highway Iron Products Co., Ligonier, Ind., are very reasonable in cost.

Contractors and county road commissioners will do well to investigate the "Hipco" type of culvert form. Descriptive circulars will be sent on application addressed to the Highway Iron Products Co., Ligonier, Ind.

When Ordering Revolving Screens

Remember that the size of perforations in a revolving screen will give a product of smaller size than the perforation itself. The difference in the size of stone that will pass given size ring (by hand) and the same size hole in a revolving screen is due to the angle of the screen plate where the stone passes through. For example, if specifications require stone of a certain size, it is understood that the cubes are to pass a given ring by hand; therefore, in ordering revolving screens for a certain size product a reasonable allowance should be made to compensate for the difference in the size of material that will pass a ring by hand and the holes in the revolving screen.

SYNSTONE PRODUCTS

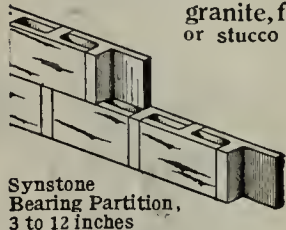


This SYNSTONE SINGLE WALL is being used for rebuilding Halifax.

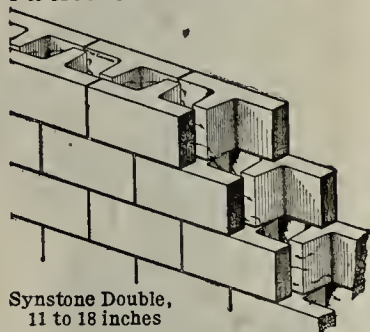
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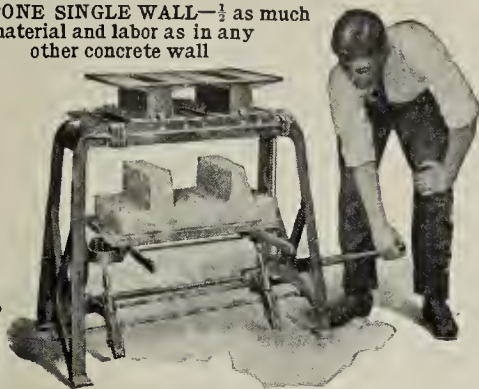


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Synstone Double, 11 to 18 inches

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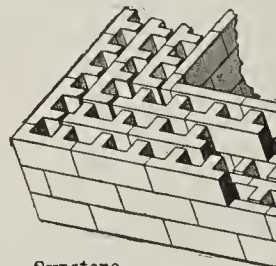
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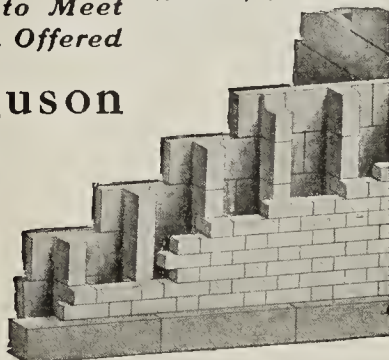
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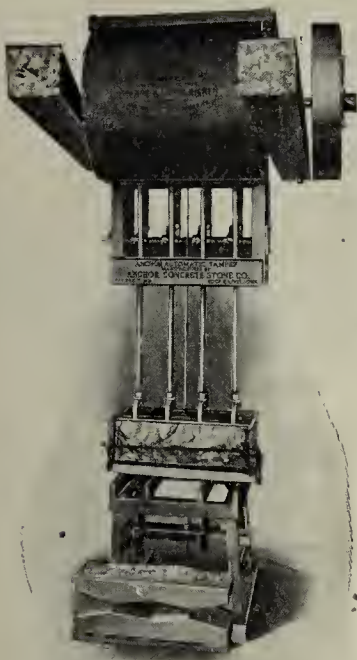


Synstone Wide Wall, 19 to 60 inches

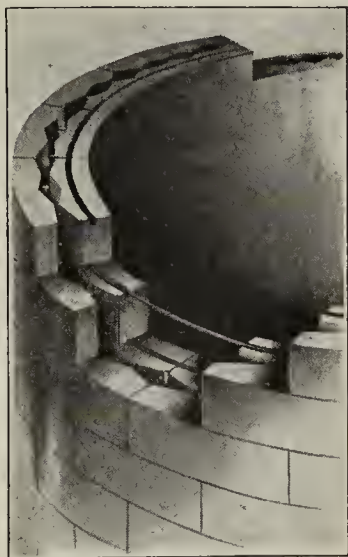


Synstone Brick Veneer Wall, 13 to 17 inches

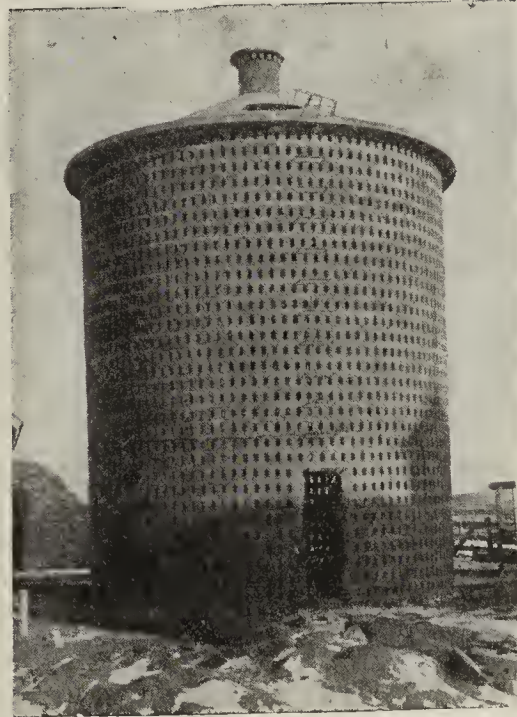
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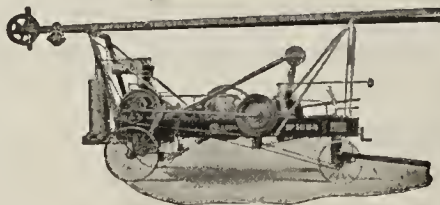
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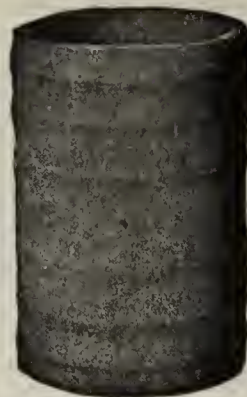
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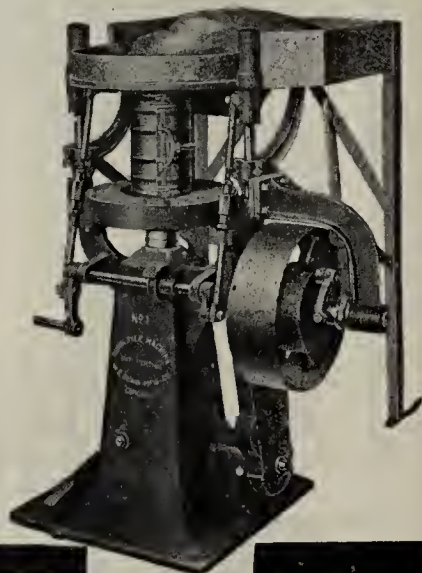
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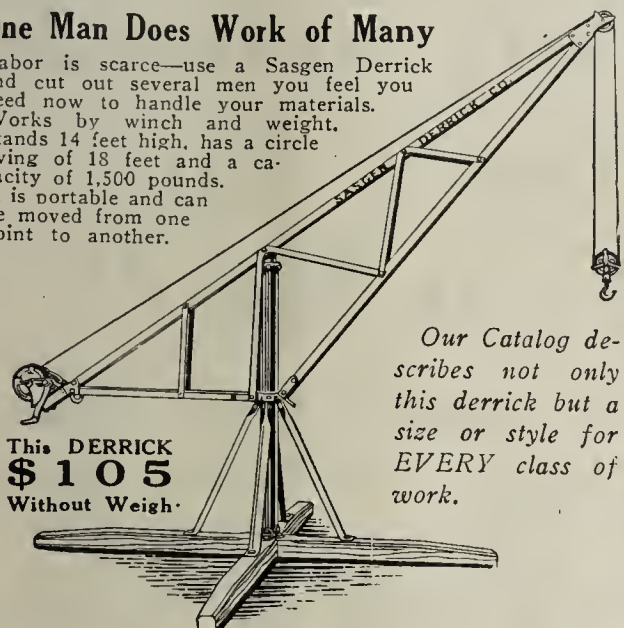
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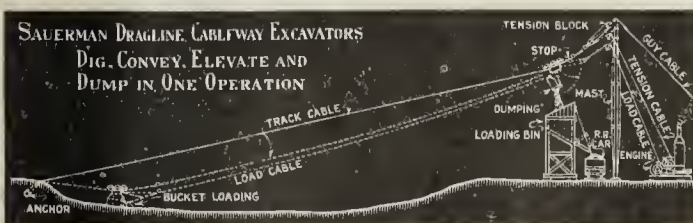
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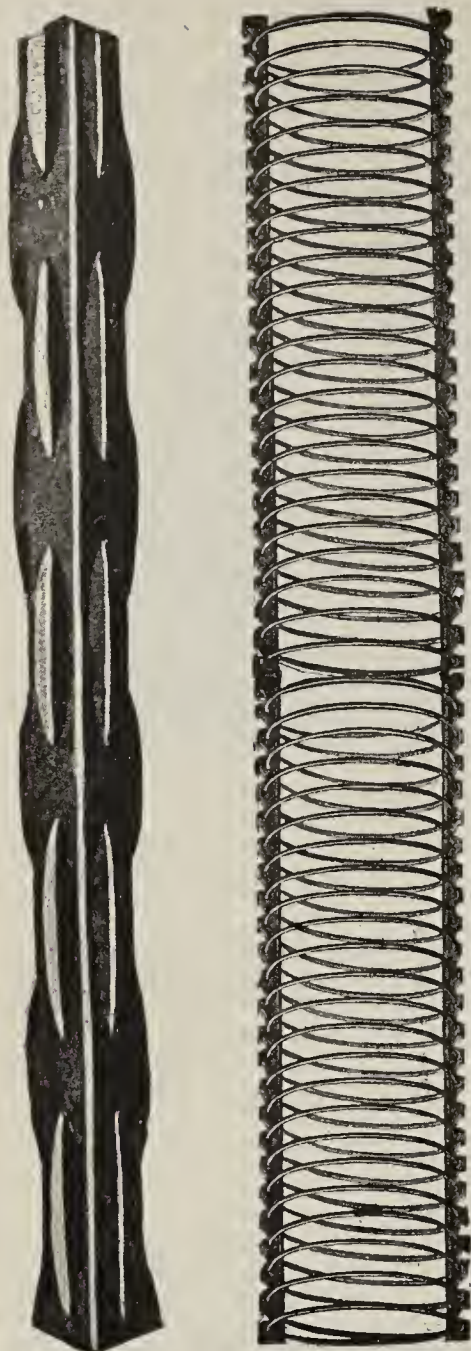
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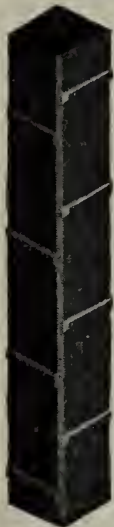
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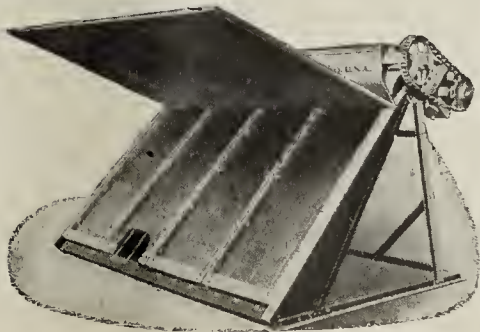
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Additional mixing in a minute makes **Cube Concrete** extra-workable—it is more easily spread and tamped and finished.

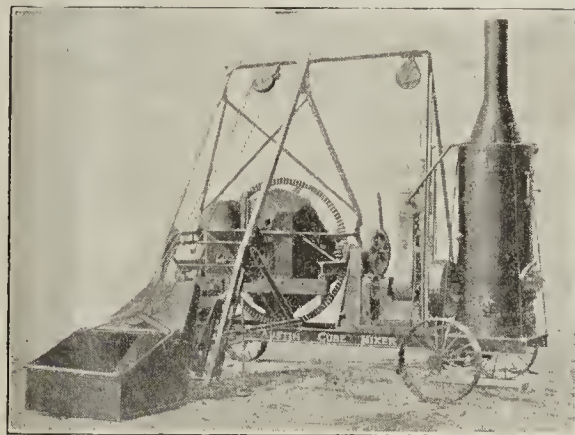
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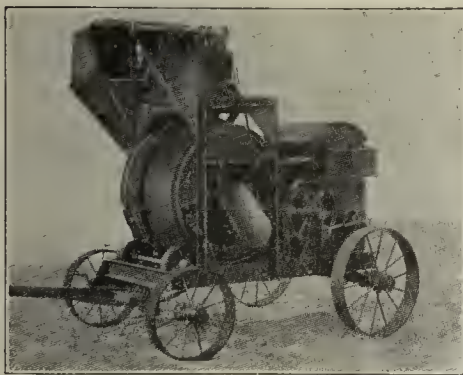
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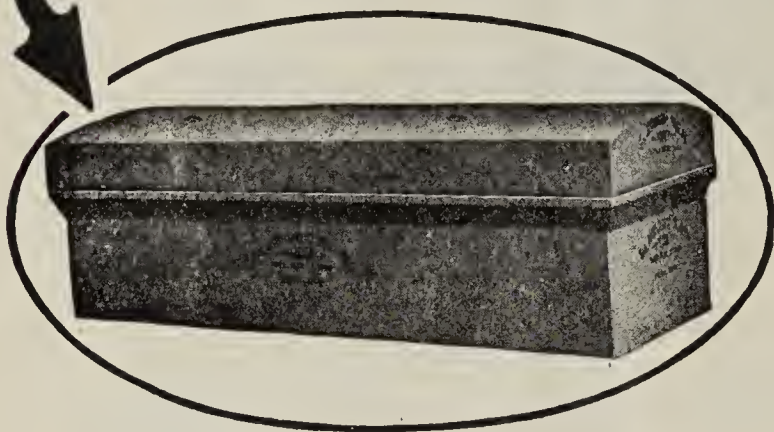
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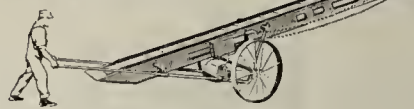
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Truscon Waterproofing Paste Concentrated provides certainty of results and economy in costs. Certainty because it has proved itself. Used in many thousands of buildings and it has always given perfect results. Economy because it is the only concentrated waterproofing material on the market. It contains absolutely no fillers—every particle possessing maximum waterproofing value. This provides the lowest cost per cubic yard.

Learn about Truscon Waterproofing Paste Concentrated by receiving Structural Waterproofing. This handsomely illustrated volume, 8½x11 inches, will be sent free on request written on business stationery.

The Truscon Laboratories

Manufacturers and Inventors of
Waterproofings, Dampproofings,
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DETROIT

MICHIGAN



DAMP-PROOFING PERCOPROOF COMPOUND

Makes Foundations
impervious
to Moisture : : : :

APPLIED with a brush direct to foundation walls, concrete construction, masonry or stucco surfaces, Percoproof forms an unbroken, elastic facing that fills every pore and crack and prevents all seepage and moisture from penetrating.

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for our
Damp-Proof-
ing Booklet.

Unlike ordinary waterproofing materials, Percoproof contains no oil and requires no thinning. It comes ready for use and is equally satisfactory in all climates and at all seasons.

Eight Thousand Gallons of Percoproof were used for waterproofing the eighteen great buildings that constitute the Cincinnati General Hospital.

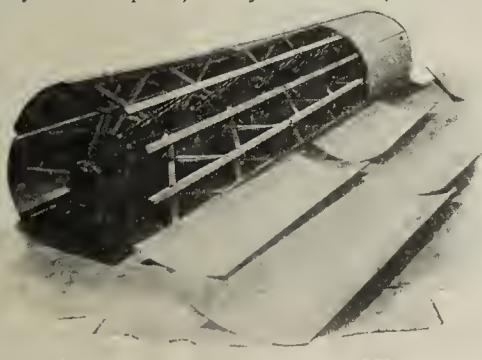
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'HIPCO' Culvert Form

Adjustable to 39 different diameters, of any and all lengths. Easily portable, quickly set in place, easily withdrawn, nests in small storage space, cuts concrete culvert costs wherever used. Roller bearings—nothing complicated.

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Highway Iron
Products Co.
Ligonier, Indiana



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BY THE LONGEST
SUCCESSFUL SERVICE
OF ANY PULVERIZED COAL
EQUIPMENT ON THE MARKET.

The Aero Pulverizer is a complete pulverized coal plant in one machine.

Built in five standard sizes ranging from 600 pounds to 5,000 pounds of coal per hour.

Write for literature

The Aero Pulverizer Co.

Room 1441 Equitable Bldg.,

New York

INVESTIGATION AND EXPERIENCE ARE PROVING THE RELIABILITY OF HYDRATED LIME

FOR WATER PROOFING AND TO FACILITATE POURING CONCRETE



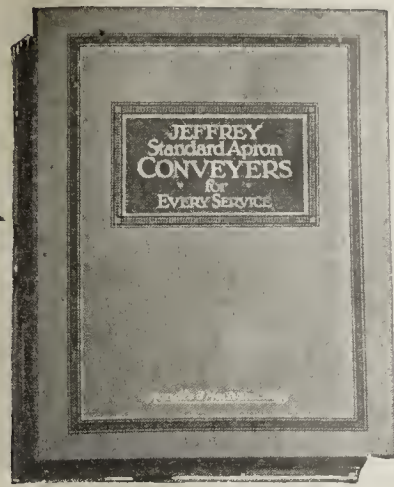
In these 51 concrete storage tanks, recently erected in Cedar Rapids, Iowa, by the Quaker Oats Co., there are approximately 12,500 cubic yards of concrete—1-2-4 mix. The walls are perfect cylinders, with no lips or bulged surfaces.

Hydrated lime was used for waterproofing and also to facilitate pouring the concrete and lifting the forms, owing to its lubricating properties. In mixing, 25 pounds of hydrated lime was put into each batch, which made the percentage of lime to cement a little over 8% by weight. The mixers used were of such size that three bags of cement could be used in each batch.

Considerable credit is given by the Leonard Construction Co. of Chicago to the lime. The statement is made that the lime gave the exterior surface a white and uniform appearance, and that the surface needed no subsequent coating. There were no joints where the concrete stuck to the forms and "lifted," as it does in many cases where the concrete is not of uniform mixture.

Write any of the following competing manufacturers of Hydrated Lime for complete information about Hydrated Lime in Concrete

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Port Byron Lime Assn., Port Byron, Ill.	Palmer Lime & Cement Co., 103 Park Ave., New York, N. Y.	Kelley Island Lime & Transport Co., Cleveland, Ohio	Woodville Lime Products Co., Toledo, Ohio
Lee Lime Co., Lee, Mass.	Rockland & Rockport Lime Co., New York—Rockland, Maine—Boston	National Lime & Stone Co., Carey, Ohio	Merion Lime & Stone Co., Norristown, Pa.
White Marble Lime Co., Manistique, Mich.	The A. & C. Lime Co., Canton, Ohio	Ohio Hydrate & Supply Co., Woodville, Ohio	Vermarco Lime Co., West Rutland, Vt.
Glencoe Lime & Cement Co., St. Louis, Mo.	Hunkins-Willis Lime & Cement Co., St. Louis, Mo.	Riverton Lime Co., Riverton, Va.	Union Lime Co., Milwaukee, Wis.



Just off the Press

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The Jeffrey Standard Apron Conveyers are so arranged in this book that not only the Engineer, but the layman, who is more or less unfamiliar with conveying machinery, can easily select a conveyor which will completely meet his requirements, insuring quick delivery and saving the time and expense heretofore required in making drawings and layouts, special designing of chains, flights, etc.

*Write today for your copy
of Catalog No. 258-D.*

The Jeffrey Mfg. Co.
914 North Fourth Street
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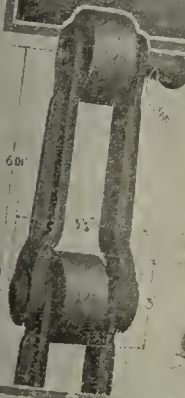
Increasing Production

Below a Jeffrey Wood Apron Conveyor has been installed in the Plant, increasing the number of trucks which can be loaded in the second floor of the machine shop. It is a ground floor storage building. The conveyor system shows a large capacity, while the large capacity of the conveyor is shown in the reverse side of the machine.



Heavy Slabs Will Stand Much Hard Usage

Not only will the heavy slabs stand much hard usage, but they will also stand much hard usage. The heavy slabs are made of a special material, which is designed to stand much hard usage. The heavy slabs are made of a special material, which is designed to stand much hard usage. The heavy slabs are made of a special material, which is designed to stand much hard usage.



CEMENT AND ENGINEERING NEWS

with which Gravel & Stone Magazine is incorporated

22 Quincy Street, Chicago.

(PUBLISHED MONTHLY)

William Seafert, *Publisher and Editor*

J. F. Waldron, *Advertising Manager*

R. M. McCully, *Business Manager*

Telephone, Harrison 5397

Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, \$1.00 per year; all
other countries, \$1.50 per year.
Single Copies 20c.

DISCONTINUANCES—The greater part of our subscribers prefer NOT to have their subscriptions interrupted, in case they fail to remit promptly for renewal. It is therefore assumed, unless notification is given to the contrary, that the subscriber wishes to continue taking our paper. Therefore CEMENT & ENGINEERING NEWS will be sent until we are notified to discontinue—Such notice should be sent when the subscription expires.

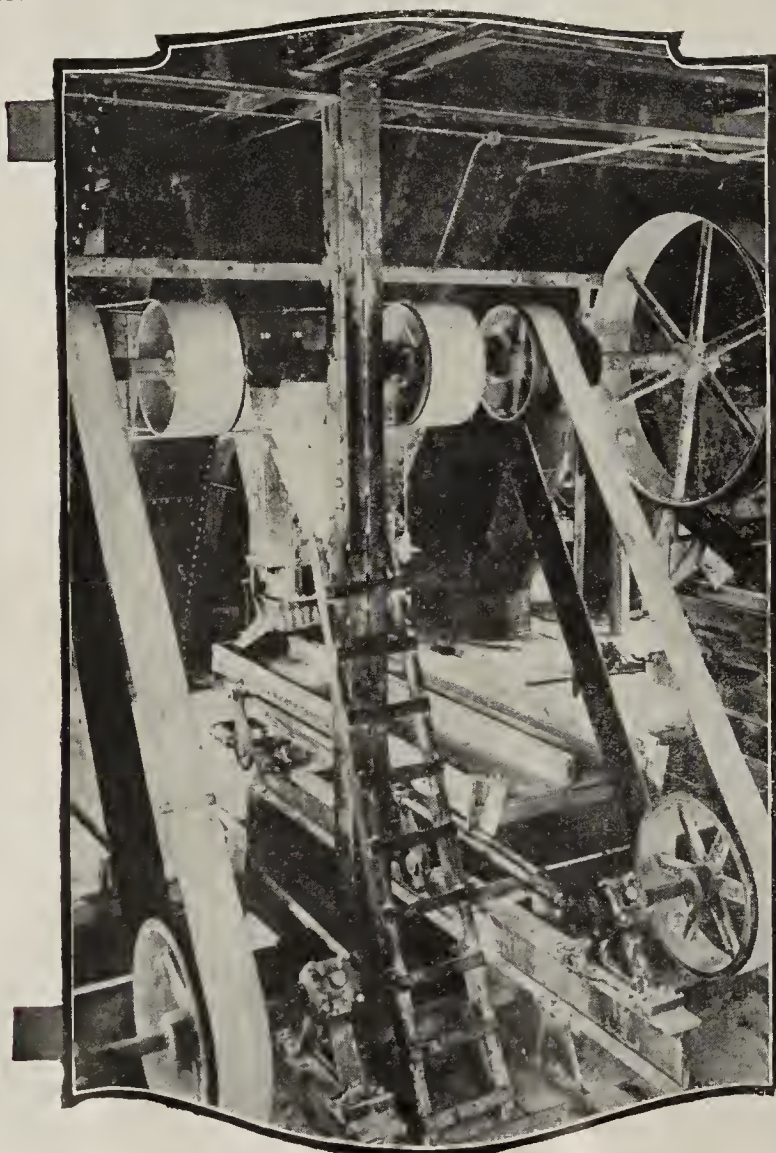
Advertising copy or changes in ads. must be in this office by the 25th of each month, as hereafter our magazine will appear on the 5th of the following month

Advertising Rates Sent on Application

Vol. 31 CHICAGO,, AUGUST, 1919 No. 8

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Stitched Canvas Belting

For hard, gruelling service transmitting power—on both main and counter drives—as well as on elevator and conveyor work, Sawyer Stitched Canvas Belting cannot be excelled.

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Put in 400 or 600 Yds. Paving or Floors a Day.

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Built in "one bag" size complete with Automatic Power Loader-
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Keokuk Iowa

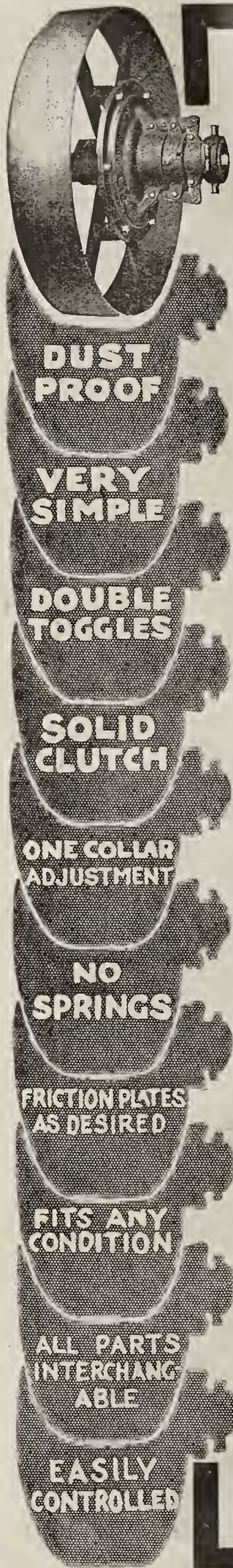
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PROMPT DELIVERIES FROM STOCKS IN FOLLOWING CITIES:
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Plamondon Disc Type Friction Clutches have every known feature that makes toward efficiency, economy and durability in clutches. For the most economical transmission and distribution of power and easy control of the same, there can be no logical choice but that of the

PLAMONDON DISC TYPE CLUTCH

Plamondon Clutches defy the most adverse conditions. Their absolutely dustproof construction renders them particularly suitable for use in cement mills, etc.

We have a 57 years' service record for this clutch.

Write for our new catalog No. 59

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12 to 24 N. Clinton Street
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We manufacture Spur Gears, Bevel Gears, Miter Gears, Spur Mortise Gears, Bevel Mortise Gears, Miter Mortise Gears.

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Spur, Spiral, Bevel and Worm
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Accuracy and Prompt Delivery

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stand first in accuracy—perfect mesh—silent operation and the quality that counts for long service.

*Estimates furnished from drawings and specifications.
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SPUR GEAR SPEED REDUCERS

Note they are dust proof, compact, made in any horse power or reduction. Just what is needed on conveyors, elevators and reduction of speed anywhere. We manufacture cut gears. Send for catalogue.

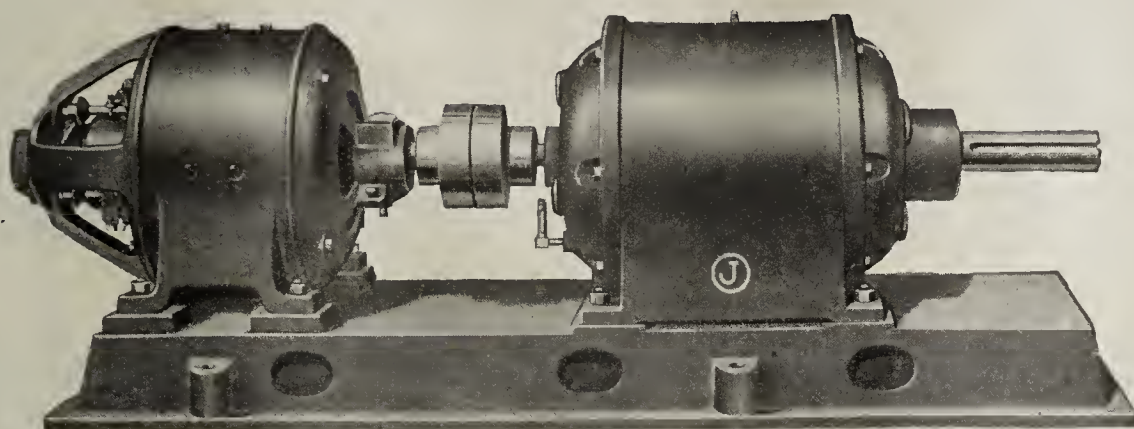
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The "CINCINNATI" FROG AND SWITCH COMPANY
Established 1906
CINCINNATI, OHIO

Portable and Industrial Track

Frogs Switches Crossings
Switch Stands Rail Braces

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We Do Not Always Advise the Installation of Jones Spur Gear Speed Reducers.

If, after a careful study and analysis of stated conditions, our engineers are not satisfied that Jones Reducers will prove to be the most satisfactory solution of your speed reduction problems, they will not hesitate to tell you so.

When you submit your speed reduction problems to us you have the assurance of an honest answer, and a practical solution of the case by engineers who are specialists in this line of work. Write today. No obligation.



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4406 Roosevelt Road
CHICAGO

Established 1890

30 Church Street
NEW YORK

"Type A" Auto-Starter

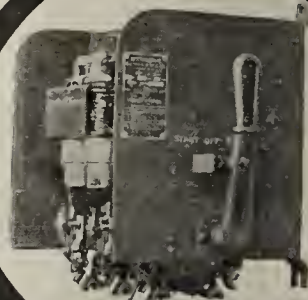
For Cement Industry

To supply an auto-starter which would meet the rigid requirements of present day service, the Westinghouse Company offers a new type A auto-starter, with the following important features:

1. It has an open-hearth steel case.
 2. It has a low-voltage relay, mounted inside the case.
 3. It has fuses or overload relay, mounted inside the case.
 4. It has a safety device that disconnects the motor when cover is removed.
 5. It has a safety device to lock starter in OFF position when repairs are being made to machinery.
 6. It has voltage-reducing transformers designed to permit changing from light to heavy duty starting.
 7. It has non-inflammable micarta base.
 8. It has contacts the same as used in steel mill automatic, and heavy main line locomotive controllers with a rolling and wiping action when opening or closing.
 9. It has contacts mounted in such a manner that they may be removed or replaced without disturbing the wiring or the mounting of the starter.
 10. It has special insulation in the voltage-reducing transformers.
 11. It can be installed with or without conduit.
 12. It requires minimum expense for installation.
- In the development of this auto-starter, no detail has been omitted to—
 Insure greater safety to the operator.
 Afford the best protection for expensive machinery.
 Reduce the expense of upkeep and installation; and
 Give greater reliability in operation.



Auto-starter complete

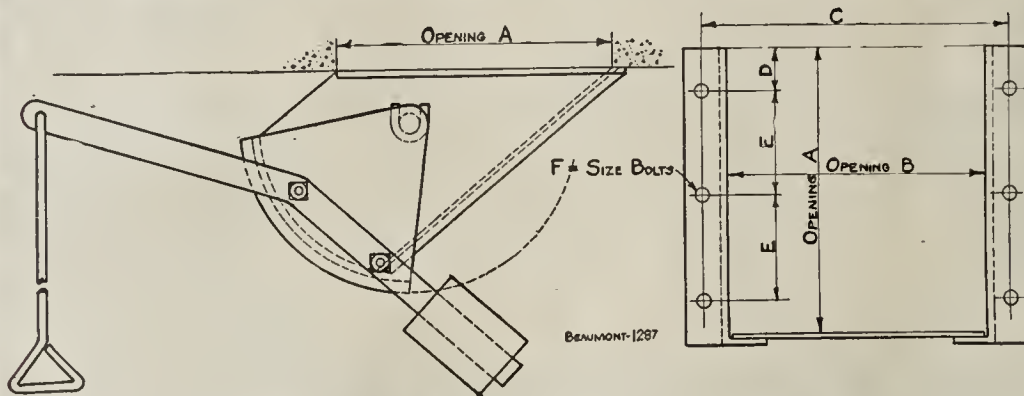


Auto-Starter with cover removed

Westinghouse Electric & Manufacturing Co.
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Westinghouse



Lever Undercut Gate

An undercut gate should always be used for material containing large lumps, as an overcut gate will close down on a large lump and remain partly open, allowing the finer material to drain out. This gate is made for attaching to side of bins as well as to the bottom.

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The Aero Pulverizer is a complete pulverized coal plant in one machine.
 Built in five standard sizes ranging from 600 pounds to 5,000 pounds of coal per hour.

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New York

"HERCULES SOLID WELD" STEAM SHOVEL CHAIN



The Chain that puts the SHOVE
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MADE ONLY BY

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DAMP-PROOFING PERCOPROOF COMPOUND

Makes Foundations impervious to Moisture :: ::

APPLIED with a brush direct to foundation walls, concrete construction, masonry or stucco surfaces, Percoproof forms an unbroken, elastic facing that fills every pore and crack and prevents all seepage and moisture from penetrating.

Unlike ordinary waterproofing materials, Percoproof contains no oil and requires no thinning. It comes ready for use and is equally satisfactory in all climates and at all seasons.

Eight Thousand Gallons of Percoproof were used for waterproofing the eighteen great buildings that constitute the Cincinnati General Hospital.

THE PHILIP CAREY CO. 132 Wayne Ave., Lockland, Cincinnati, O.

WRITE
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Damp-Proof-
ing Booklet.

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"V-B" Balata

"AMPERE"
(Canvas Stitched)

"WHITE SEAL"

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Ribplex has a wide range of use in light, permanent, fire resistive roofs, walls, floors and partitions, in all sorts of structures.

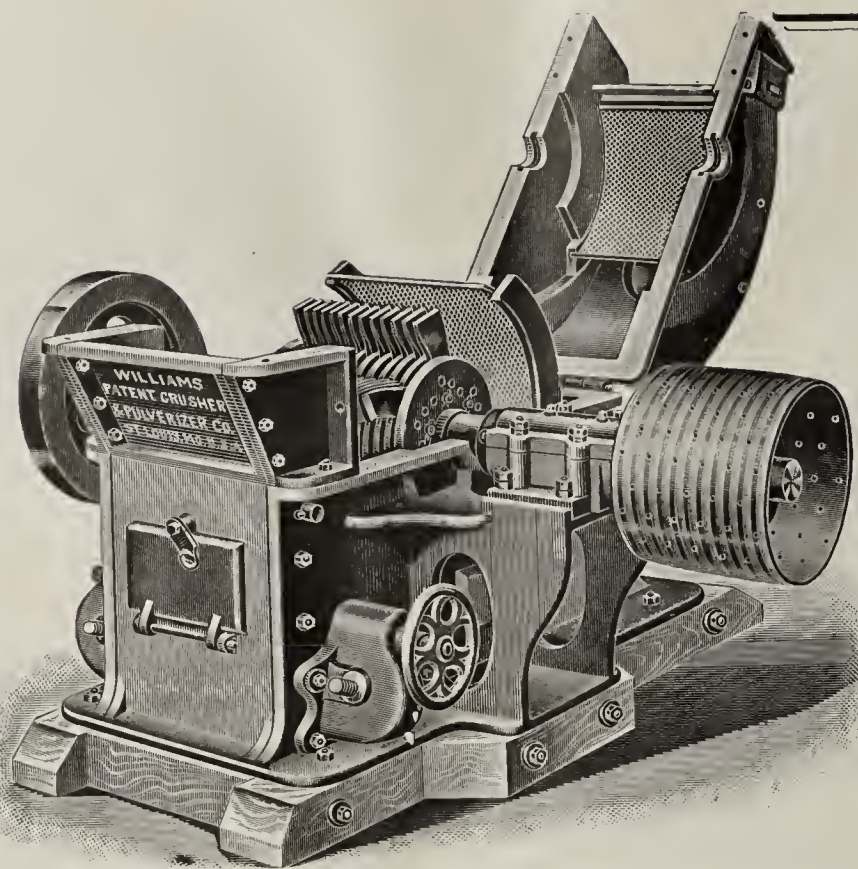
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CAPACITIES RANGE FROM 1/4 TO 30 TONS PER HOUR

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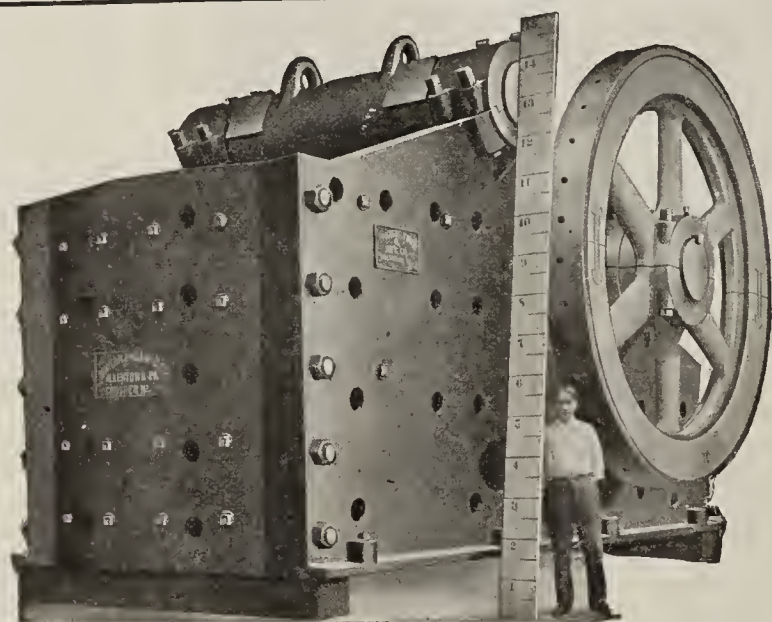
There is undoubtedly room in your plant for one of these machines, which, in the last twenty-two years have proven that they are money savers, can be depended on, and really have merit. If further information is desired, Write for Bulletin No. 17, which is brim full.

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Traylor 60"x86" All Steel Jaw Crusher

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Are Built in All Sizes from 7"x10" to 66"x86"

The 66"x86" is the largest crusher built.

All Traylor Jaw Crushers have cast steel water cooler pitmans.

Extra size pitman and swing jaw shafts of finest hammered steel.

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A CRUSHER FOR EVERY PURPOSE

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The last word in Gyrators.

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They eliminate the personal equation in automatically preventing tire corrugations.

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Long or short for wet or dry grinding. Have water cooled bearings of extra size. Positive automatic feed that assures maximum tonnage for minimum horse power.

The Traylor Ball Tube Mill

For reducing lumps to fines in one step.

"THE ULTIMATE CRUSHING EQUIPMENT"

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are reducing costs in quarries, gravel pits and construction work. There is an ATLAS Explosive for every blasting requirement.

The ATLAS Chemical Laboratories, Research Division and Service Division are all working together for a single purpose—to enable users of ATLAS Explosives to get the best results at the lowest cost.

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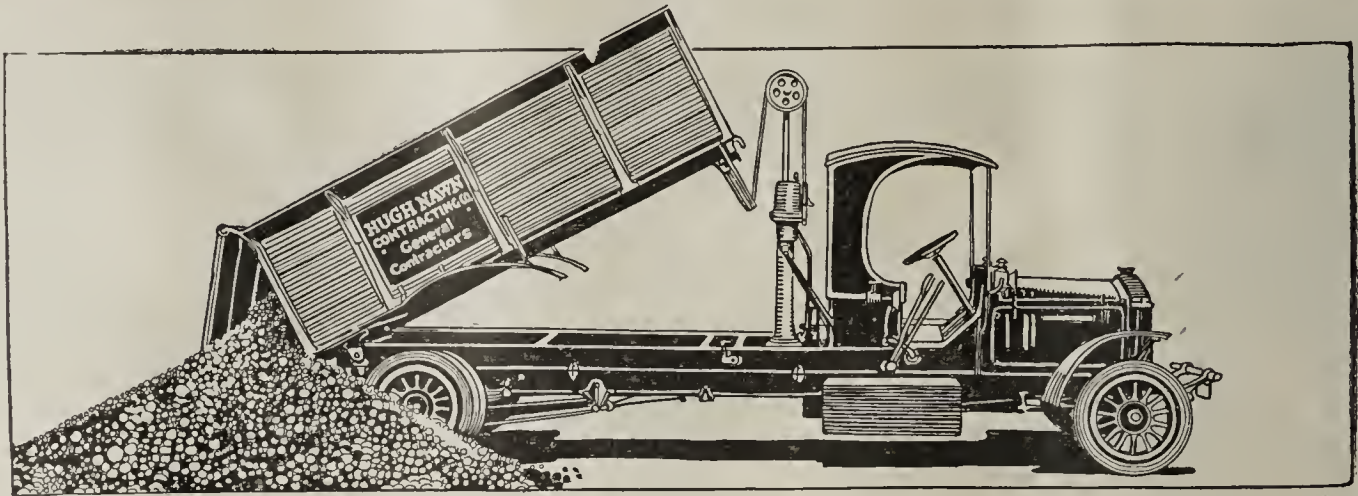


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break the rock right



Hugh Nawn compares year's operating costs for two well-known makes of Motor Trucks

Hugh Nawn, the Boston contractor, long ago realized that motor trucks are the most efficient and economical hauling units for large operations. The only question in his mind was which is the best truck.

His choice finally narrowed down to two well-known makes, one the Pierce-Arrow, the other a competitive truck of high reputation. For one year these trucks were kept on similar jobs, both operating under the same accurate system of cost accounting. Neither truck was spared, and the severity of service in rush work is shown by the high tire cost for both trucks. As a result of the comparative showing tabulated below, Mr. Nawn is satisfied that the Pierce-Arrow is the best truck made for contracting business.

COMPETITIVE TRUCK'S RECORD

Miles Run	13,095
Tonnage hauled	10,768
Gallons of gasoline consumed	4,521
Pints of oil consumed	1,176
Repairs to motor	\$740.37
Labor repair cost	249.25
Tire cost	888.79
Year's operating cost excluding insurance, depreciation etc.	3,520.27
Average operating cost per day including overhead	19.80

PIERCE-ARROW TRUCK'S RECORD

15,517 Miles Run	
11,013 Tonnage hauled	
4,389 Gallons gasoline consumed	
385 Pints of oil consumed	
\$136.16 Repairs to motor	
152.91 Labor repair cost	
841.78 Tire cost	
Year's operating cost excluding insurance, depreciation etc.	2,768.96
Average operating cost per day including overhead	16.78

A number of other interesting installations are shown in our booklet, "What Pierce-Arrow Motor Trucks Are Doing In The Contracting Business." We shall be glad to send you a copy.

THE PIERCE-ARROW MOTOR CAR CO., BUFFALO, N. Y.

PIERCE-ARROW

Motor Trucks



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reduces the efficiency of labor and destroys the working parts of your machinery.

Allis-Chalmers Dust Collectors

remove these troubles by extracting dust from the air, and salvage valuable products.

Let us solve your dust problems and give you the benefit of years of experience.

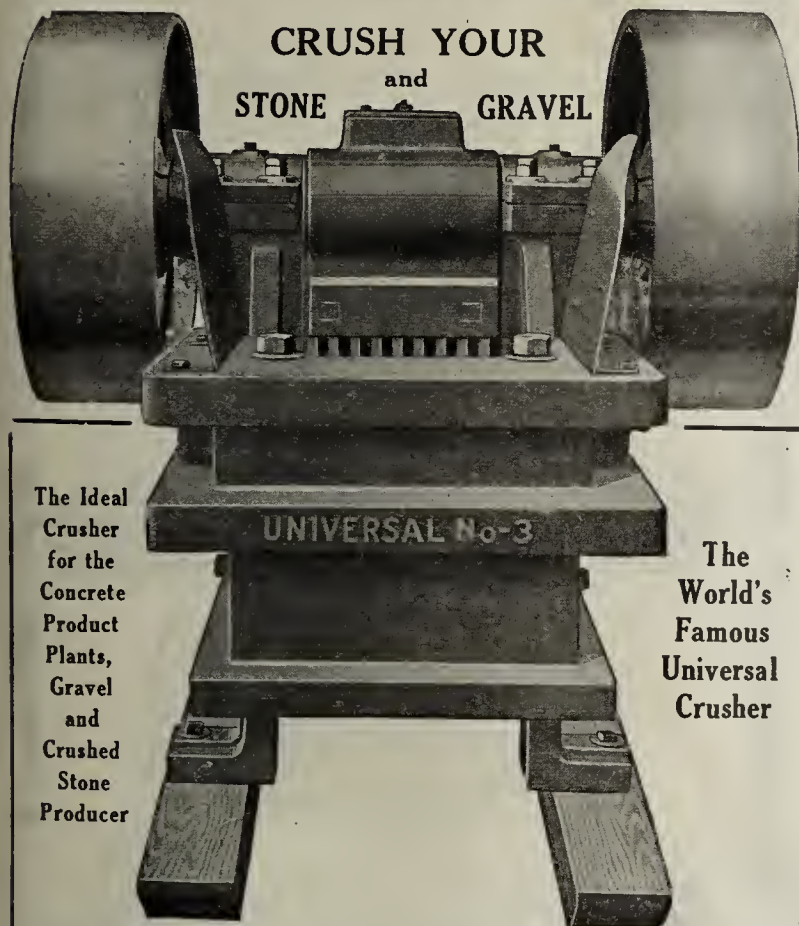
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Our name in your assurance.

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CRUSH YOUR
STONE and GRAVEL



The Ideal
Crusher
for the
Concrete
Product
Plants,
Gravel
and
Crushed
Stone
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The
World's
Famous
Universal
Crusher

**We Build Crushers from 5 Tons to 300 Tons
per 10-hour Capacity**

Instantly adjusted to produce size required from
 $\frac{1}{4}$ inch to 3 inches Write for Folder No. 14.

UNIVERSAL CRUSHER COMPANY

230 Bee Ave

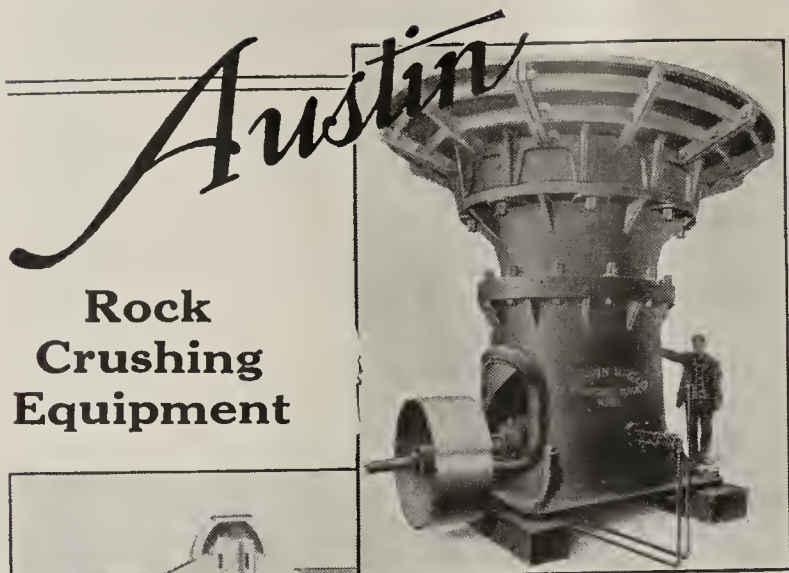
Cedar Rapids, Iowa, U. S. A.

SAND PUMPS OF ALL TYPES

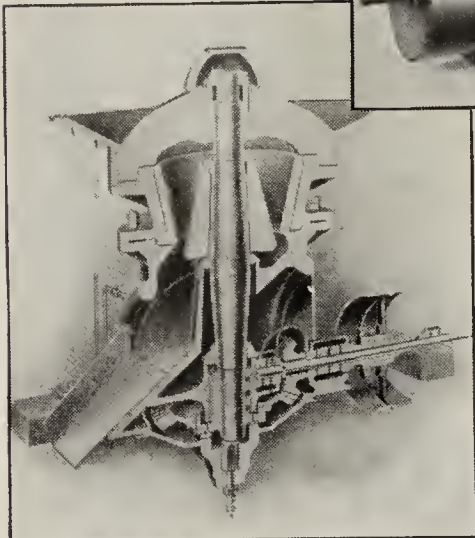
The Kingsford Sand and Dredging Pumps are built in all sizes for Engine, motor or belt drive and can be furnished with or without linings.

Our single stage Centrifugal and Multi-stage Turbine Pumps are guaranteed the most efficient made.

**KINGSFORD FOUNDRY &
MACHINE WORKS**
OSWEGO, N. Y.



**Rock
Crushing
Equipment**



**Examine
Both
Inside
and
Out**

The more you look into the internals of the **Austin Gyratory Rock Crusher**, the better we are pleased. For the real mechanical superiority of any machine lies in its working parts. When a prospective user examines the details of the **Austin Crusher** he finds numerous practical features not found in others—features which insure greater durability and output with little wear and tear and less horse power consumed.

Austin screens, elevators, quarry cars, hoists, etc., as well as the gyratory crusher, are looked upon as "standard" by quarrymen and engineers who know what good machinery is.

Our new quarry equipment catalog, fully illustrated, and descriptive of the entire Austin line, is now available and will be sent to you upon request.

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Chicago, Ill.

Branch offices:

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Capacity**

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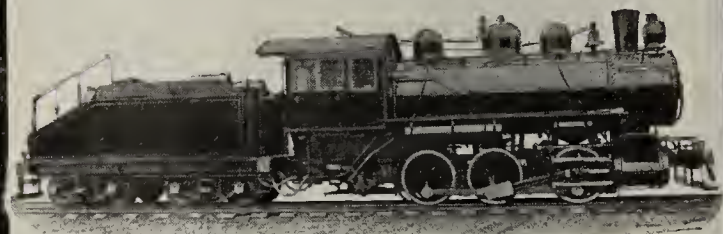
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Its regular daily performance was 134.1% efficient.

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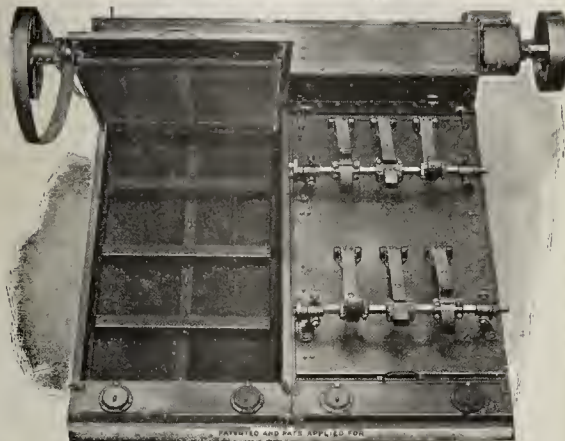
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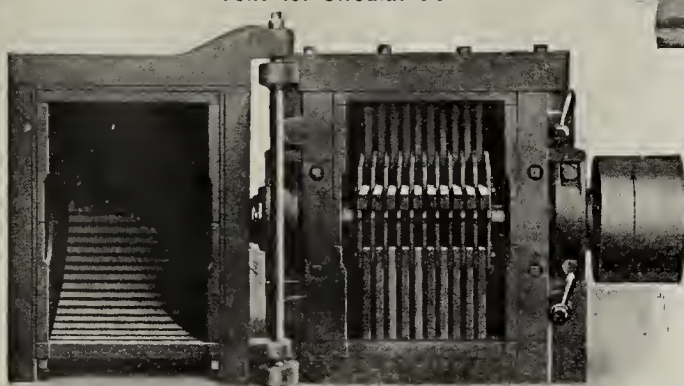
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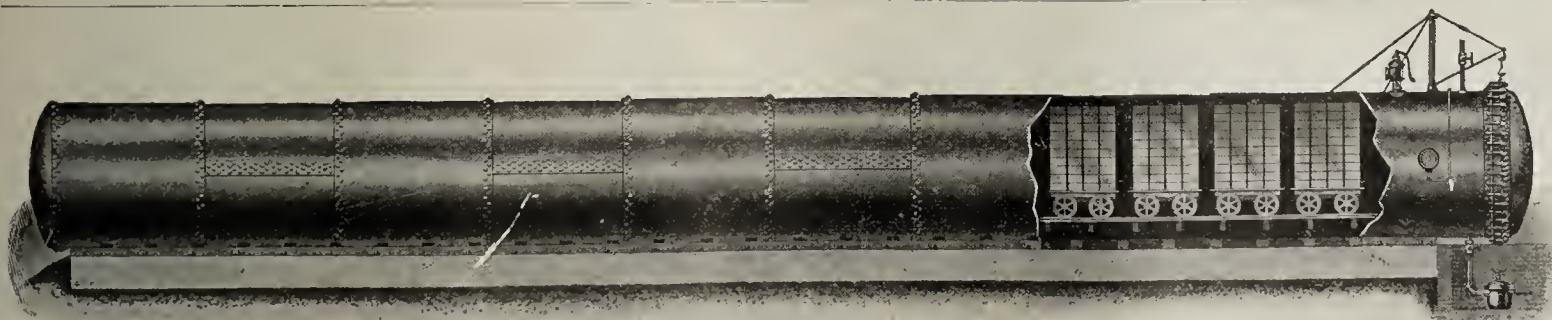
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Our complete line of Sand Lime Brick Machinery makes it possible to secure just that machinery which is required to make your plant a success. We favor no particular type of machinery but are guided by the needs of the customer. Our wet and dry grinding mills have transformed a number of unsuccessful plants into dividend producers, while our Presses, Mixers, Hardening Cylinders and other equipment are of equal quality. We can exactly meet the demands of any manufacturer with a quality of machinery which will operate at a profit with a minimum amount of attention and expense.

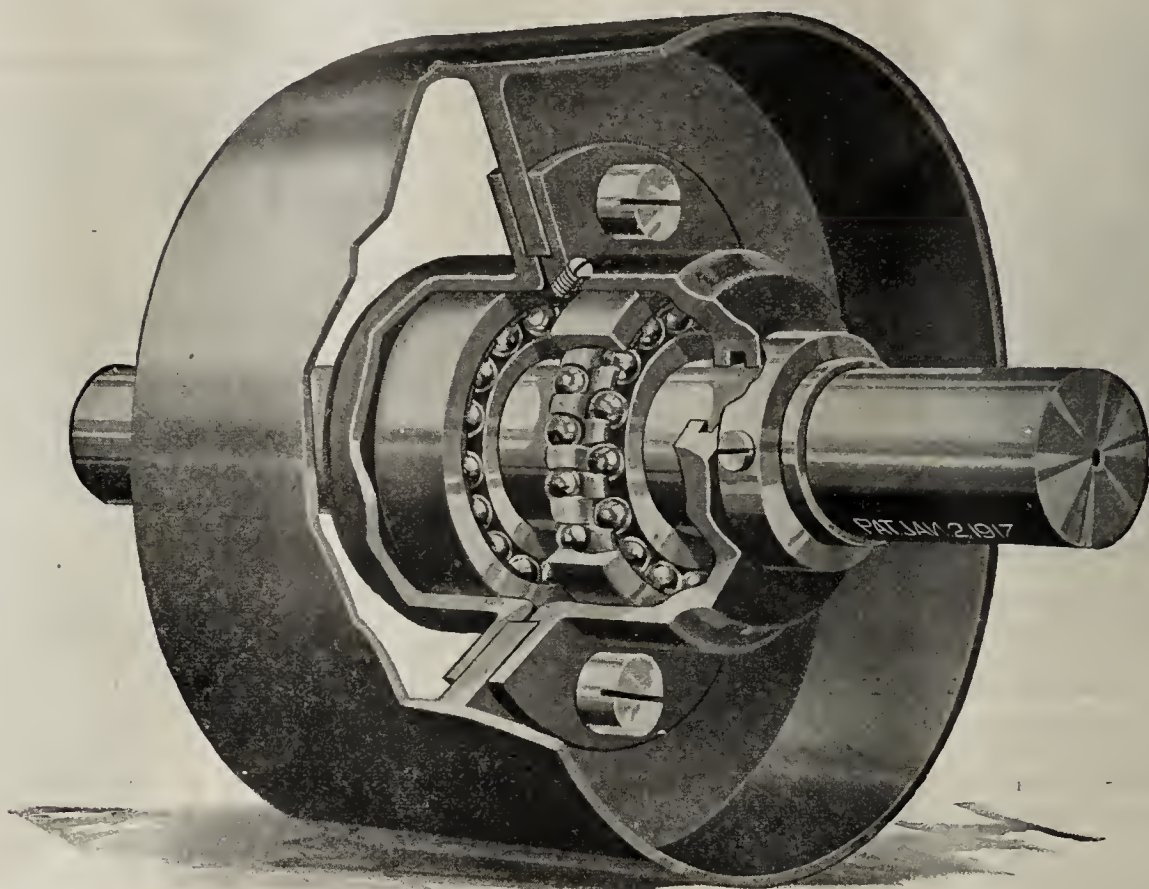
Correspondence solicited

The American Clay Machinery Co.

WILLOUGHBY, OHIO

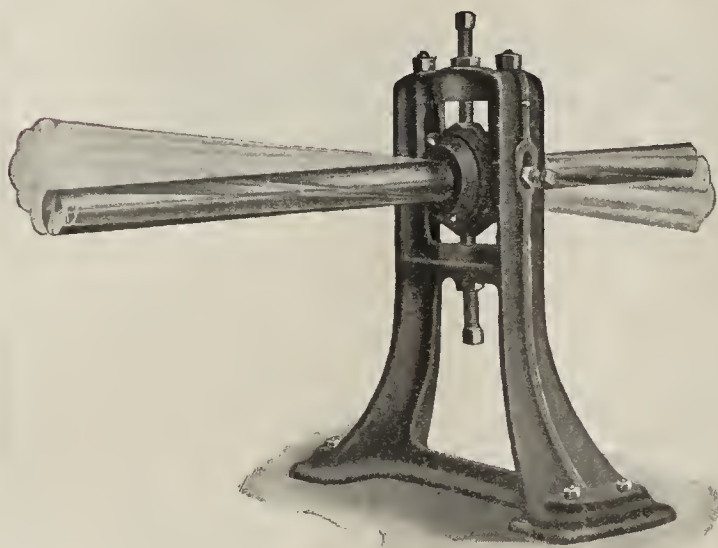


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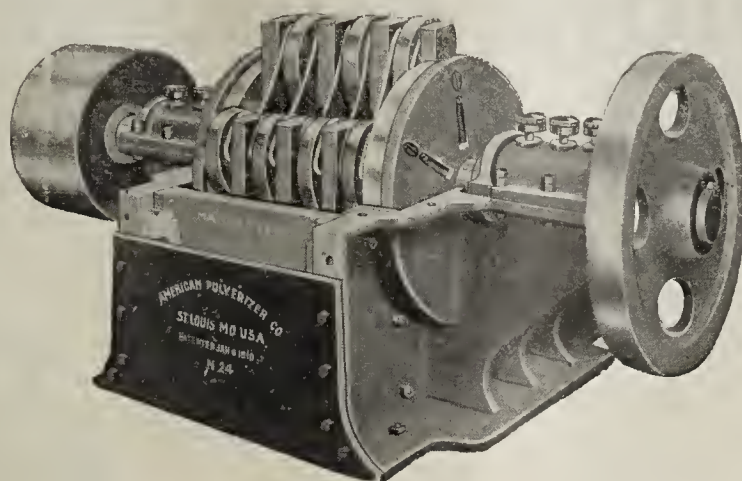
The Rings: Each 27-lb. ring has a 1-ton striking force and a $1\frac{3}{4}$ -ton centrifugal force, slides ten times per second at any given point. Its striking, rolling, grinding operation reduces the speed.

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Steel: All crushing and grinding parts are made of manganese steel, giving long life to the equipment.

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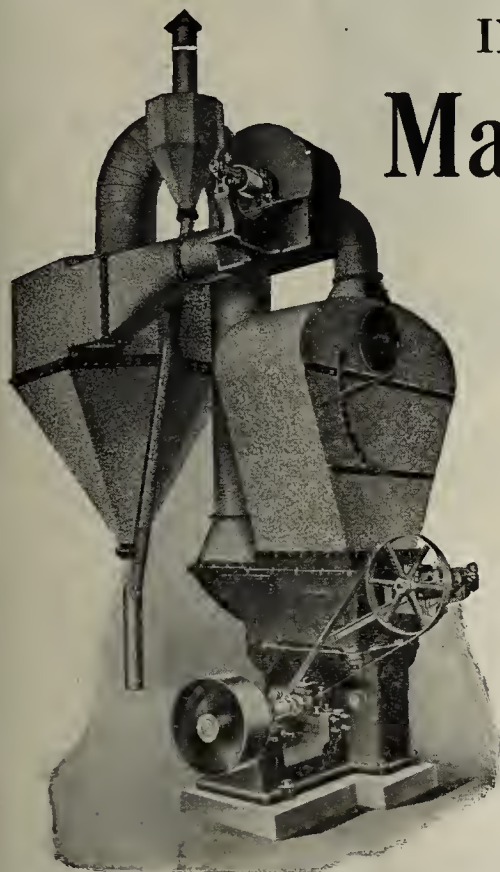
The American Ring Pulverizer is manufactured in six sizes. It crushes and pulverizes shale, coal, limestone, gypsum, slag, etc. Write for complete descriptive catalog.

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St. Louis, Mo.

Complete Grinding IN ONE Machine



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grinding
Cement, Clinker,
Limestone, Coal

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Ask for BULLETIN 1015 Showing a Variety of Uses



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The John F. Byers Machine Co.

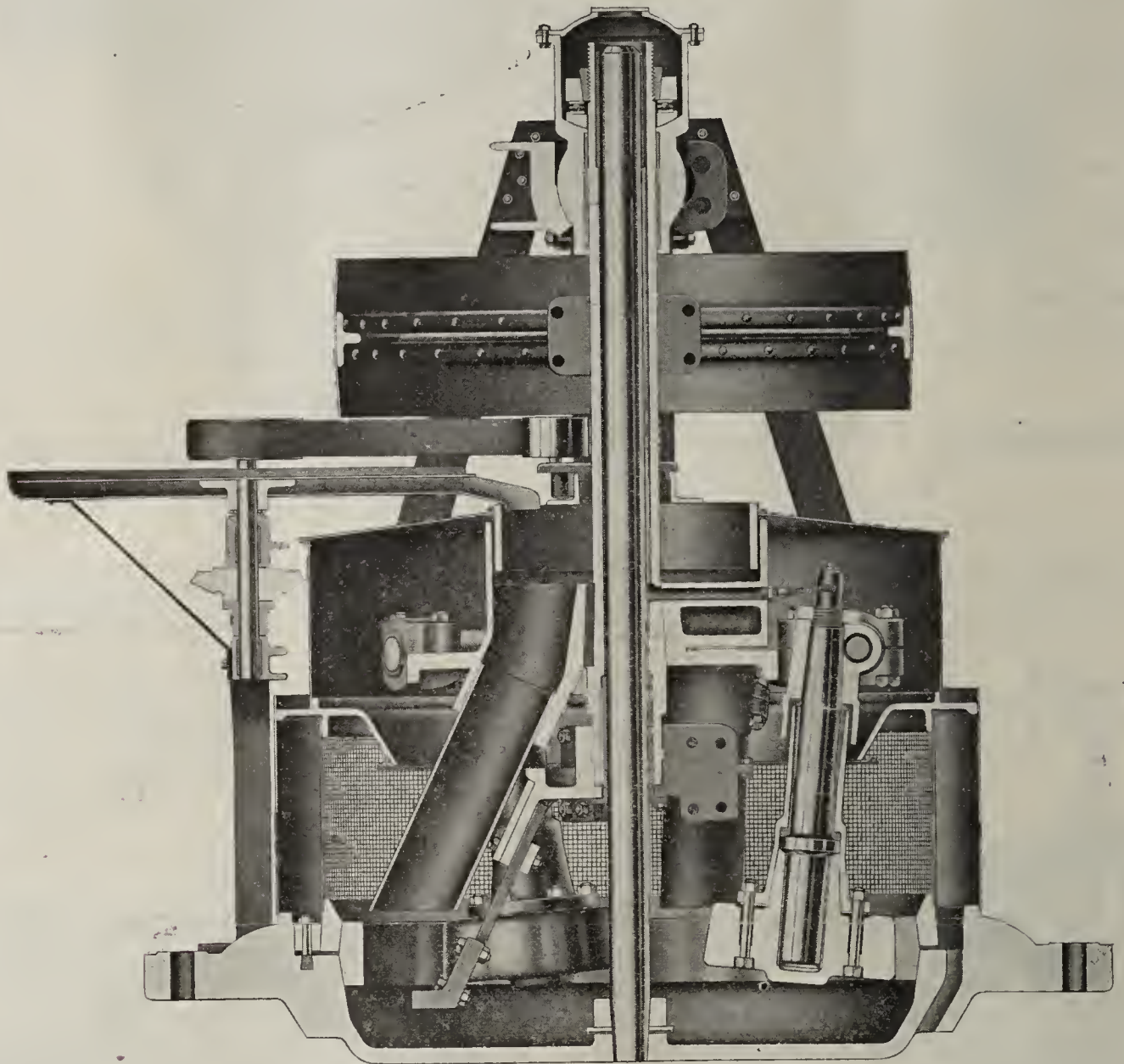
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Bradley Pulverizer Co.

Boston

Works: Allentown, Pa.

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Cement and Engineering News

Vol. 31

Chicago, August, 1919

No. 8

Dirt Roads

By Walt Mason

The highway running east and west
Is but a sad and sorry jest,
In drouthy seasons it will do;
Then motor cars along it choo,
And loaded teams climb up its hills,
And dislocate no poles or thrills.
And this is why I sometimes say
The government should do away
With rain and moisture of that stamp,
So that the road may not get damp.
For when the water drips and pelts,
That doggone highway simply melts,
Like sugar in a cup of tea,
And there's no thoroughfare to see.
Some drowning mules we may behold,
And autos from the culverts rolled,
And swearing men who ply the jaw
And say there ought to be a law.
We've blown in millions more or less
To make the road a big success.
We've graded and we've plowed and dragged,
We've engineered and cussed and bragged,
We've foundered horses by the herd,
To make the highway less absurd.
And when the weather's good and dry
It pleases the esthetic eye;
It's scraped and manicured so nice
We think it's surely worth the price;
We bowl along its dusty miles,
Our faces wreathed in beaming smiles.
Then Pluvius uncorks his trough,
It rains, and all the stuff is off.
I wonder if we'll ever rise,
Unswerving purpose in our eyes,
And build the kind of roads that last
Through vernal rain and wintry blast?

C O N C R E T E

Editorial

Profit-Sharing

The tendency of well organized businesses and governments is to extend benefits to the individuals who compose them. Universal well-being is a product of democracy, and slowly but surely our political system has brought with it the disposition on the part of employers to give the employe a share in the responsibilities and benefits arising from industrial and commercial enterprise, through various methods of profit-sharing.

The question very naturally arises as to why any employer of labor should give anything more than the wages or salary agreed upon. Although at first glance it might appear that any additional grant to the employe would be actuated only by philanthropic motives, yet after investigation, it proves to be profitable to both employer and employe.

Profit-sharing benefits the employer by anticipating a demand on the part of the employe to share in the wealth which he has aided in creating. A voluntary concession on the part of the employer avoids such a demand with a lower percentage of actual capital outlay than the ordinary demands on the part of the laborer would involve. At the same time, the saving effected by the stabilization of labor conditions in his organization enables the profit-sharing employer to give his workers much higher rewards than would otherwise be practicable. Thus the working and income conditions which profit-sharing produces go far toward eliminating discontent and preventing labor difficulties.

Cultivation of the individual workman's interest in his daily tasks is another desirable result of profit-sharing. Men and women work because necessity demands that they meet their daily needs. Nevertheless, there is no incentive to voluntary endeavor and the exercise of personal initiative so potent as a valuable consideration given in special recognition of service rendered. The best method for stimulating such personal interest is through the reward for meritorious services by means of a bonus or profit-sharing system.

Stabilization of labor is, perhaps, the most profitable phase of profit-sharing from the employer's viewpoint. Every employer of labor realizes the tremendous loss sustained through the labor turnover due to replacing employes who leave on account of apparent advantages to be gained through a change. A bonus system obviates this difficulty, for it holds the higher grade of employe at a lower net cost than would be possible without such a system. The workman receives more money, but the total amount paid out by the firm is less, because the increase paid through the bonus or profit-sharing system is less than the loss sustained by continuously hiring and training new men.

Waste reduction and prevention constitute another profitable element of profit-sharing. Everyone working on a profit-sharing basis has a selfish interest in endeavoring to eliminate waste and in raising the standard of efficiency. This disposition, of course, tends to increase profits.

The development of good-will among the general public is another highly profitable outcome of profit-sharing.

Purchasers have greater confidence in firms employing a bonus or profit-sharing system, for the maintenance of such a plan not only argues well for the stability of an organization, but also gives an assurance of fair dealing and satisfaction. A firm that deals fairly with its employes will certainly do the same with its customers. The contracts of such a firm, too, are more dependable, for there is but little risk of disappointment in deliveries through delays caused by labor difficulties.

The benefits of a bonus system or profit-sharing plan, of course, are by no means confined to the employer alone. Obviously, there is the immediate benefit of increased income achieved without resorting to drastic measures. Under such a system there is no need for strikes, whose cost is always paid by the workman.

Profit-sharing, moreover, tends to increase the individual worker's earning capacity insofar as it stimulates his interest in his work and thus leads him to the development of more efficient methods of performing his duties. The logical outcome of such interest and development, of course, is greater ability with consequent, greater rewards. Recognition of such progress is necessarily swift under a profit-sharing system, for careful supervision and scrutiny of the work of every individual constitute an integral part of the plan. Consequently, the efforts of the energetic and ambitious worker are sure to be noticed. The incompetent workman is spurred on to meet the standard set by the competent workman, and the energetic workman is spurred on by the knowledge that service rendered will receive recompense in just proportion.

In most profit-sharing systems, the pecuniary advantages accumulate by arithmetical progression, and are thus cumulative in the later years of a man's active life.

Profit-sharing systems give the employe assurance of continued employment, and such assurance permits him to formulate definite plans for the thrifty management of his affairs. As soon as a man feels that he is permanently employed, he can establish himself by buying his home, thereby beginning the accumulation of an estate.

What plan is most desirable and most adequate in a given establishment depends largely upon the nature of the business and its organization. Any system, however, based upon the fundamental principle of reward for service, will prove mutually profitable and advantageous to employer and employe. It is possible to accomplish the desired results, for instance, by giving to the employes a percentage of the gross or net profits of the company.

Another method is to grant bonus stock after service of several years. In some companies this stock is given after two years of service, to those deserving, on the basis of 1/60th of a share per month. The total stock share, therefore, becomes the property of the employe at the end of a period of five years after it is granted, but, in the meantime, the recipient, or grantee, receives the full dividend income.

A number of other stock bonus grants for meritorious service prevail. Some of the larger cement manufacturers have insured the lives of all their employes, in favor of the employes' dependents, for sums ranging from one thousand to one thousand five hundred dollars, according to length of service, without cost to the employe.

Cement Company Insures Lives of Its Employees

The employees of the Marquette Cement Mfg. Company, La Salle, Ill., were given a pleasant surprise recently when announcement was made that the company has insured their lives without cost to them, the insurance covering death from any cause, and payable to the beneficiary named by the employee. This is entirely apart and distinct from the benefits of the regular compensation insurance. The insurance applies to any employee who has been in the service of the company six months or more, including the company's officials.

The insurance is issued by the Equitable Life Assurance Society of N. Y., and is on the Group Plan, which is regarded as one of the latest and best developments in life insurance. It shows a substantial and generous appreciation of the value of loyal and continued service. A unique feature of the form adopted by this company—an increasing scale of insurance based on length of employment—encourages faithful and continued service.

One of the attractive features of group insurance is that no individual examination of employees is required, the only examination being a broad survey of the general working conditions of the men.

Announcement was made through a letter delivered to every employee today, which reads as follows:

Copy of Letter

La Salle, Ill., July 16, 1919.

"After careful survey of the best methods of showing our appreciation of the loyalty and continued service of our employees, it has been decided to furnish and maintain for every person who has been in our employ continuously six months or longer, insurance against death, without expense to them.

It is particularly pleasing to announce by special arrangement with the Equitable Life Assurance Society of the United States the life insurance upon our present employees will be granted without medical examination, as in every group many of our employees would not be able to pass the strict requirements for individual insurance.

The amount of insurance is based according to length of service as follows:

All employees in service more than 6 months or less than 1 year.....	\$500.00
All employees in service more than 1 year and less than 2 years.....	600.00
All employees in service more than 2 years and less than 3 years.....	700.00
All employees in service more than 3 years and less than 4 years.....	800.00
All employees in service more than 4 years and less than 5 years.....	900.00
All employees in service more than 5 years...	1000.00

This insurance will be paid to the beneficiary in cash. If an employee leaves our service the certificate is cancelled.

In effecting this arrangement, the Corporation is not actuated by any false notion of philanthropy or paternalism, but rather by the desire to show, in a practical manner, the value of true loyalty and continued service.

Yours very truly,
Marquette Cement Mfg. Co.
By Richard Doyle, Supt.

Approved:
Robert S. Schultz,
Works Manager.

Introducing the Bank

What is the best way to pay employees? Many concerns pay cash, believing that actual money is most convenient for their workers. But others pay by check because danger of robbery is involved in transporting large sums of money to outlying districts, and employees themselves are apt to be robbed, or lack facilities for depositing money in a safe place after they get it. Payment by check is also more convenient to the employer as the pay roll can be made up more quickly and with less work. But the employee who receives wages on the form of a check has to cash it somewhere. Very often he hesitates to enter a bank, and is embarrassed by the formalities of identification. Consequently, pay checks are often cashed in questionable places. There is a definite barrier across the door of the commercial bank which keeps many a wage earner out. It is wholly imaginary—built in his own mind. Yet it exists, and must be reckoned with, and broken down. In "System" an Illinois concern describes an ingenious solution for this problem. To encourage employees to cash their pay checks at the local banks, the company pays a premium of 1 per cent. Across the face of the check appears this notice:

"If this check is deposited by original payee to his personal account, in any regularly established bank in Quincy, Ill., within 30 days from date, such bank is hereby authorized to add 1 per cent of face amount to credit of depositor and charge to Collins Plow Co."

In practice it has been found that employees not only take advantage of the premium to increase their earnings, but that they have opened savings and checking accounts at the banks. Such a premium offers an excellent opportunity to teach thrift, and unquestionably it could be paid in Thrift Stamps or War Savings Stamps by arrangement between employers and bankers.

Public Conference to Standardize Invoices

National Association of Purchasing Agents to Adopt a Standard Invoice Form

Sales managers, auditors, systematizers, credit men and purchasing agents are interested in the movement on the part of the National Association of Purchasing Agents, through its standardization committee, to adopt standard forms for invoices, purchase orders, acknowledgments and notices of shipment.

This association, through the same committee last year adopted a standard catalog size. This catalog size is to be pushed by the association through the use of millions of poster stamps and printed matter.

The size of the catalog was arrived at after consultation with representatives of twenty-three Associations of industry and trades. The committee now has called a conference of individuals and representatives of associations to meet at the Bellevue-Stratford Hotel, Philadelphia, Saturday, September 20th, at 10 A. M., to consider the subject of standardization of forms for invoices and related documents.

The purchasing agents are vitally interested in the sizes of invoices and other papers in order that they may be filed conveniently. They are also interested in having certain information blanks printed on the forms. They desire this information to appear always in the same place on each form.

There are many problems that affect the accounting side of business which must be taken into account, which problems have a direct bearing on the size and

arrangement of these forms. The committee is seeking the co-operation of everyone who can supply information which will aid in selecting the most practicable size and arrangement. The committee feels that representatives of associations can render service both to the business world and to the members of their organization by attending this conference to see that the needs of the particular industry they represent may be properly looked after.

The effect of this conference will be far reaching, and undoubtedly the attendance will be correspondingly large.

The standardization committee of the National Association of Purchasing Agents is composed of the following members:

W. L. Chandler, chairman, Dodge Sales and Engineering Co., Mishawaka, Ind.

W. V. C. Bulkeley, Liberty Steel Products Co., Woolworth Building, New York City.

H. H. Meehan, A. B. Dick Co., Chicago, Ill.

A. Lockwood, Lumen Bearing Co., Buffalo, N. Y.

F. L. Kulow, Willard Storage Battery Co., Cleveland, Ohio.

Anyone interested in this conference may address the chairman or any member of the committee.

Cement Prices and Production in Oregon

"The Oregon cement mill at Oswego, Oregon, is a thorn in the side of the Central California producers who wish the whole of this market for themselves, and if they could succeed in crushing the Oregon company they immediately would add the freight rates to their base mill price, and cement in Portland would be selling for \$3.10 instead of \$2.59 a barrel, or 51 cents more than the present price."

This statement came today from George Macdonald, secretary of the Oregon Portland Cement company, in reply to statements recently made by George C. Macdonald Jr., local manager of the Henry Cowell Lime & Cement company of California, in the controversy over a contract for furnishing the state highway commission with 23,000 barrels of cement for highway construction.

Recently bids were received for the cement and all were for the same price. Instead of awarding the contract to the Oregon Portland Cement company for the home product, the commission gave the contract to the California concern. The Associated Industries of Oregon and other boosters of home products protested against the award with the result that Governor Olcott ordered the state highway commission to delay the signing of the contract pending an investigation.

George C. Macdonald Jr., local member of the Henry Cowell Lime & Cement company, recently made a statement to the effect that his firm never would have made a fight for the contract but for the reason that Oregon Portland Cement company is agent for the Riverside Portland Cement company and is selling cement from Riverside in the Oregon market in competition with other California cements.

To the statements of George C. Macdonald Jr., of the California concern, George Macdonald, of the Oregon company, makes some pertinent comments. Although the men are of the same name and hail from Bonnie Scotland, they are not of the same family. However, they have the same fighting propensities and there may be some interesting developments later.

George Macdonald said:

At the time the state highway commission was preparing to ask for bids for construction of the Yamhill-

McMinnville highway, the commission asked our company to give a guaranteed price for cement. We did that, and the price was incorporated in the specifications furnished prospective bidders on the work. Our guaranteed price therefore became public property with the result that the California cement manufacturers submitted practically the same bid.

Prior to 1916, the California producers supplied Oregon with practically all the cement used in the state. When we commenced producing cement in 1916, we immediately cut the market price 20 cents a barrel, to the state highway commission, and the California people met the price. That cut was maintained throughout 1916, 1917 and 1918, but in 1919 we did raise the price 10 cents a barrel, due to the increased cost of labor and material. Our increased cost, as a matter of fact, was considerably more than 10 cents a barrel.

The Oregon Portland Cement company is the only concern manufacturing cement in this state. We employ about 150 men and our payroll approximates \$700 a day. The total cost of manufacturing cement by our company is paid to Oregon labor, and the capital behind our organization is four-fifths Oregon money. Hence we feel that where we offer cement to the state at as low a price as any other producer, and where our quality is better, that we ought to have the business.

It is true, as charged, that the Oregon Portland cement company has sold California cement in Oregon. On account of the freight rates, we are unable to compete with the California manufacturer at Astoria and other coast points and some places in Southeastern Oregon, bordering on California, and in order to supply our customers at these points, we have shipped Riverside cement. We have also sold a small quantity of Riverside cement to dealers in Portland, for the reason that we did not have storage and wharfage facilities always to handle our own product here, and we supplied some of our customers direct from California. But we have not sold a barrel of California cement to the Oregon highway commission, nor have we offered them a barrel of California cement, nor do we intend to. We are prepared now to furnish the highway commission 1,000 barrels a day of Oregon cement, and will give a bond guaranteeing to do so.

The Oregon Portland Cement company is, comparatively speaking, a small institution, while the California producers have huge plants and unlimited capital. They make it impossible for us to enter the California market, and they give us a hard fight for the Oregon market. We are having a desperate struggle in competing with them right here in Oregon.

Hardly a dollar of the money paid by the State of Oregon or Oregon people for California cement remains within the state, while all that we receive for our cement stays right here in Oregon. Hence we feel that if our price is as low and our quality as good as the California producer, that the business should be ours. We are trying to develop and build up an Oregon industry, and we are in the fiercest kind of competition with people engaged in the same line of business, but located in the State of California.

I just wonder if the people of this state realize that the Oregon Cement company couldn't sell a barrel of cement to the California highway commission? After our investigation we wouldn't even submit bids nor go after the business, because we know that state pride, if nothing else, would find some way to circumvent us, even if we should quote under the California manufacturers. The same is true of the state of Washington. It hasn't been very long since Portland people were told by a secretary of a Washington state com-

mission that they would be wasting their time to supply the state with bids on supplies, as it was the policy of the state to patronize home industries.

If this community would ask what the Oregon Portland Cement company has done for Oregon, we would say that besides keeping \$500,000 in Oregon last year they also saved the people 51 cents per barrel on 500,000 barrels of cement, or approximately \$250,000. This is what they have done. Today cement is selling in ten barrel lots in San Francisco for \$2.80 per barrel, in Seattle for \$2.75 per barrel, and in Portland for \$2.59 per barrel.

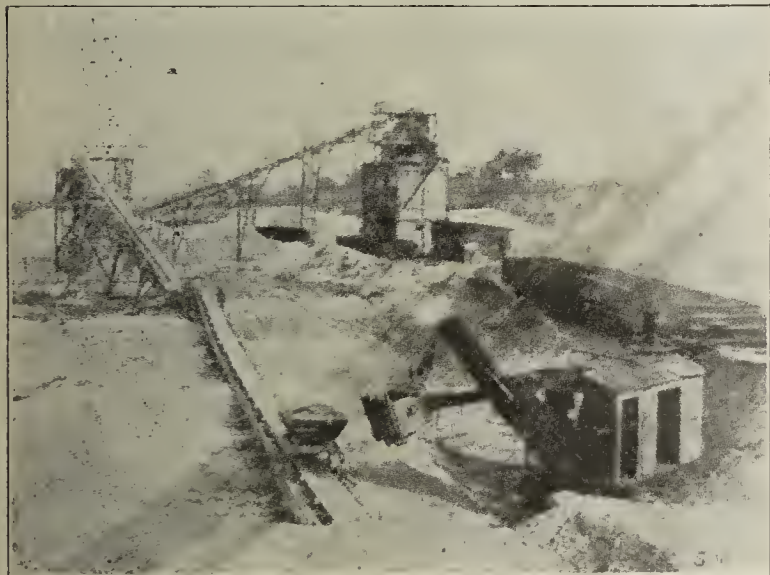
We would ask the people to stop and consider, with the Oregon cement mill out of existence, whether or not they would continue to enjoy the retail price in Portland of 21 cents per barrel lower than that in San Francisco, or whether or not they would receive the San Francisco price plus the freight rate.

The people of Oregon, by statute, have placed the state on record as favoring home industry, even to the extent of a 5 per cent preferential, but W. L. Thompson, state highway commissioner, in what we consider rank discrimination against Oregon industries, in moving a resolution to the effect that a 23,000-barrel contract be awarded a California cement company, when our price was as low and our quality and service infinitely better, has in our opinion told the people of Oregon plainly that it is a disadvantage to manufacture goods in Oregon.

Belt Conveyor for Transporting Gravel to Storage Bins

An unusually interesting method is employed by the Standard Building Supply Company, of Grand Rapids, Mich., in transporting gravel to its storage bins. The arrangement is shown in the accompanying illustration.

The plant is unique in its design, in that three kinds of material can be produced separately or in combination, according to market requirements. In Michigan certain quantities of material are produced for winter work, and provision has been made for this feature in



Steam Shovel Loading Gravel to Belt Conveyor.

the form of a screen detached from the regular washing and crushing plant. The plant was constructed early in 1916 and has a capacity of 600 yards per day. It is located one mile south of Grand Rapids on the Pere Marquette railroad.

A steam shovel excavates the material and places it in a hopper which straddles a 24-inch portable conveyor belt. It is transferred to another 24-inch con-

veyor belt on an incline leading to a 42-inch by 16-foot dry screen, which takes out dry material for winter work. This is done usually late in the fall; in the summer it is by-passed to the inclined belt conveyor leading to the washing plant. There is a shipping track on the side and bins under the dry screen just mentioned.

Leaving the dry screen, the material is chuted onto a 24-inch belt conveyor, just mentioned, which takes it to the top of the washing belt. This belt conveyor is on 210 feet centers. At the top of the incline the material passes through a 3 by 12-foot grizzly with 2½-inch openings, the rejects going to a No. 4 Austin gyratory crusher and thence to an 18-inch belt conveyor back to the dry screen.

It is evident, therefore, that this system enables the plant to produce material dry, washed or crushed. The latter is known as "crushed stone," for which there is a local market.

The material that goes through the grizzly is passed through six 72-inch screens, three in a row, and into two settling boxes, from where it goes into the bins. Six different sizes of material are produced as follows: Crushed stone, ¼ to 1 inch; also ¼ to 2 inches; crusher chips and dust; screened and washed gravel, ¼ to 1 inch; also ¼ to 2 inches; and torpedo sand. All stone above 2 inches in diameter is crushed and put into separate bins, graded to size; or it can be run over the screen in the main washing plant and mixed through with gravel. A loading track alongside the washing plant permits shipments in railroad cars.

Inasmuch as the plant is located on a concrete road, and the further fact that it is near the city, the motor truck trade is heavy. During 1917 the company operated seven trucks daily, in addition to the railroad cars it was able to obtain.

Besides the unusual design of the plant, the machinery has had practically no break-down troubles with consequent repair bills. The Erie steam shovel, for instance, has been in constant service, and although one dipper has worn out nothing has been spent on repairs. Electric power is used throughout, the motors being furnished by Allis-Chalmers Manufacturing Co. Victor Balatan & Textile Company furnished the belting, having just shipped 520 feet of 24-inch and 250 feet of 18-inch belting.

Concrete Products

The Des Moines Cement Brick Company, Des Moines, Iowa, has been organized and has taken over the plant formerly occupied by the Enamel Concrete Brick Company at Southwest Fourteenth and Burlington tracks. George Graeser, H. L. Bump, Morris Mandelbaum and Bert Vorhees are the owners of the new plant and it will be managed by J. C. Mardis, formerly a well-known Des Moines contractor. The new plant is already in operation and the first product will go into a large Des Moines garage. The plant will specialize on a highly polished white face brick.

For the purpose of getting manufacturers of concrete pipe to maintain a higher standard and make better pipe, forty large factories throughout the state of California have incorporated as the California Associated Concrete Pipe Manufacturers, with headquarters at Fresno. C. B. Twining, of that city, who is of the five directors, said that so low has been the grade of concrete pipe construction that much of the pipe installed in California recently will not last more than a year. The other directors are: G. D. Williamson of Yuba City; J. A. Van Cleve, Jr., of Exeter; C. A. Merritt, of San Jose, and P. N. Warner, of Reedley.

St. Paul Covered Reservoir

Reinforced Concrete 30,000,000-Gallon Reservoir Built with Movable Concrete Mixing and Spouting Plant. Large Collapsible Wall and Roof Forms Mounted on Steel Travelers

The new 452x446-ft. reinforced concrete covered reservoir for the water supply of the city of St. Paul covers an area of about two and one-third acres and was built in an excavation averaging about 14 ft. in depth. Both floor and roof are made with parabolic groined arches, reversed in the floor, and separated by 20x20-in. vertical columns 16 ft. apart on centers longitudinally and transversely.

The height of the reservoir is about 30 ft. from the lowest part of the footings to the top of the roof and it is intended to store water to a depth of 20 ft. and to be covered with a minimum thickness of 24 in. of clay and loam spread over the roof.

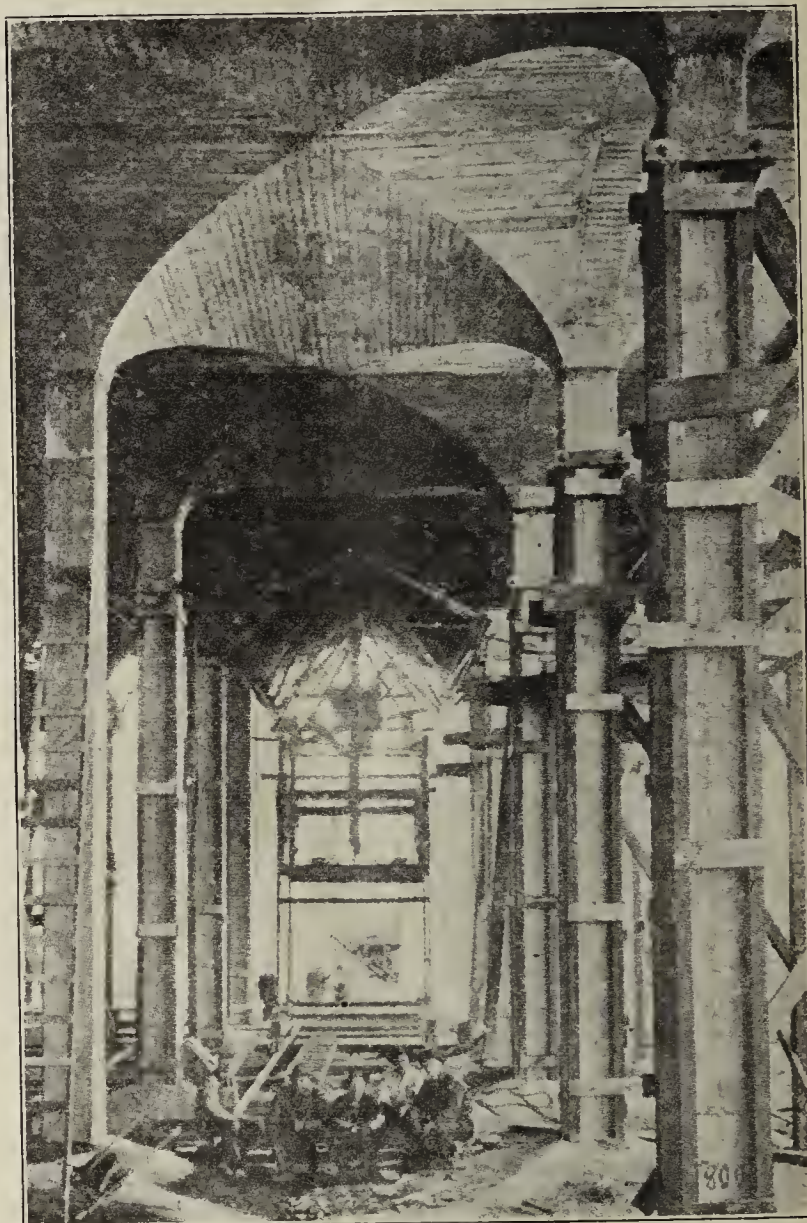
On three sides a sloping wall, 18 in. thick at the bottom and 9 in. thick at the top makes an angle of 60 degrees with the horizontal and is supported on exterior buttresses 18 in. thick at the base and 12 in. thick at the top that are spaced 12 ft. apart, and have bases 22 ft. long, perpendicular to the wall, on a continuous footing 25 ft. wide, 18 in. thick at the base of the wall, and 2 ft. thick at the outer edge. On the fourth side of the reservoir the wall 452 ft. long is of a different type intended for present independent stability, and later to form the partition wall if the reservoir is extended by the construction of another basin equal in size to the present one. This gravity wall, 6 ft. thick at the base and 2 ft. thick at the top, is seated on a continuous footing 28 ft. wide, 2 ft. thick at the outer edge and 5 ft. 6 in. thick at the center. This wall is of cantilever type without buttresses. In all the walls expansion is provided for by vertical transverse construction joints 60 ft. apart made with a flat steel plate embedded in the concrete and a corrugated copper cover plate to prevent leakage.

The floor arches are 26 in. thick at the bases of the columns and 6 in. thick at the centers. The roof arches have a clear rise of $3\frac{1}{2}$ in. and are 6 in. thick at the crown. The earth cover extends 6 ft. beyond the outer walls on all sides of the reservoir and thence is sloped $1\frac{1}{2}$ on 1 to the original surface of the ground.

Excavation and Transportation

The reservoir is located on a hill about a mile north of the city of St. Paul, and was built on a summit, contained within its walls, that originally had a maximum elevation of about 23 ft. above the reservoir floor, the surface of the ground being at elevations approximately at floor level at two corners and about 13 ft. above floor level at two other corners. This condition involved the excavation of about 100,000 yd. of earth which was done with a steam shovel, removed in dump cars, hauled over a narrow gauge service track and deposited in a soil bank on a steep hillside near the reservoir site. The excavation to a depth of about 2 ft. below the bottom of the concrete floor was done in about one month.

After the completion of the excavation, the bottom



Adjustable Steel Traveler and Form for Concreting Groined Roof Arches.

of the reservoir was covered to a depth of 2 ft., with about 15,000 yd. of clay dug from a borrow pit a mile away, brought to the reservoir in narrow-gauge dump cars and deposited wherever required as the service tracks were shifted to correspond with the progress of the work. This clay was compacted by thorough rolling in 6-in. layers.

Transportation

The construction of the reservoir involved handling 40,000 tons of material from the railroad tracks 2 miles away, and about 110,000 tons of other materials. As the site is about 300 ft. above city datum the cost of transportation was large and after making careful estimates of tractor hauling, automobile trucks, and a narrow-gauge, temporary railroad, it was decided to install the latter. This track about $2\frac{1}{4}$ miles long includes 1,000 ft. of wooden trestles, has a maximum grade of $2\frac{1}{2}$ per cent. and connected with the steam railroad and with the sand and gravel pits 2 miles from the reservoir. The cost of the service road exclusive

of rails and some other materials in contractors' stock was about \$12,000 and the transportation, although eventually as great as the estimated cost of tractor hauling, was much more rapid and enabled the construction to be completed much quicker than it otherwise could have been.

Aggregate Storage

Sand and gravel were received near the reservoir site on elevated horizontal wooden platforms, separated by a partition wall. Two service tracks carried on trestles 10 or 15 ft. above the storage platform crossed the latter diagonally and the sand and gravel were dumped from them to the floor beneath. A low level narrow gage track ran from end to end under the center line of the sand bin, and a parallel one ran similarly under the gravel bin and both of them were carried on a steep incline to the top of a hopper bin. Sand and gravel were delivered from the platform to the skip cars below through four gates on each side of each track. The cars were hauled by hoisting cable to position above the hopper bins where the end gates were opened, discharging their contents into the bins. These bins delivered by gravity to measuring cars on service tracks under the bins, each car containing exactly the required proportions of sand, gravel and cement for one batch of concrete.

The cement was first placed in the car and afterwards sand and gravel were simultaneously added by a single lever control. When it was found that the cement adhered to the car the sand and gravel were first loaded and the cement put on top, and difficulty arose from the latter blowing away. Finally sand was first loaded, then cement and finally gravel, making a somewhat slower operation and using separate levers for the sand and gravel bins.

Mixing and Distributing Concrete

Concrete was mixed in a movable plant, installed on a 16x22-ft. steel frame platform with four two-wheel trucks on a 15-ft. gauge track. The aggregate was delivered by the measuring cars to an elevating skip that charged two 1-yd. mixers that filled the buckets hoisted in a wooden tower from which the concrete was spouted distances not exceeding 50 ft., or sometimes was delivered directly to two-wheel carts that distributed it as required for floor and roof construction. The chutes were handled by a boom attached to the power and the bucket was operated by a hoisting engine which, together with the mixers, was operated by steam supplied from a 60 H. P. boiler installed on the platform.

The footing for the partition wall was first made with concrete spouted directly from the hoisting tower running alongside. The wall was then completed on its footing and a portion of one of the adjacent side walls was similarly constructed. The concrete traveler track was then moved parallel to the original position and the floor, columns, and roof for three panels of the structure were successively concreted, the plant moving back and forth as the different operations advanced, and several movements being required for each class of work. The expense and delay involved by so much movement and track shifting was found to be excessive and the remainder of the work was accomplished by the concrete plant moving on a full length center longitudinal track and concreting the remainder of the structure in successive halves, handling two panels at each operation.

The floor concreting was always kept ahead so that it set before the columns were poured. Similarly the

columns were concreted and set before the roof forms were placed and the roof arches concreted.

The concrete was poured at the rate of 24 footings in six hours, 24 columns in three hours and 24 roof arches in five and one-half hours, the maximum for one day being 330 yd. For the first season's work the average daily output was 25 yd. at a cost of \$1.43 per yd. The second year the output was increased to 155 yd. per day with the new method of operation and the total cost of placing the concrete was considerably diminished although the price of labor had increased from 25c to 40c per hr. and the turnover was so great that in order to maintain a working force of 175 men the weekly pay roll had 527 names.

Column Forms

The wooden column forms were made of vertical boards forming the side panels and connected by the usual rectangular yokes of overlapping cross pieces bolted together such as are used for columns in buildings. These forms were set up in transverse rows of three columns each, X-braced by wooden struts nailed across the forms, and two rows making six columns, were longitudinally X-braced to form a tower, the space between the second and third row was left un-



Interior View, Concrete Hoist at Left and Wall Form Traveler at Right.

braced and the third and fourth rows were similarly braced together and so on, thus forming a succession of independently stable towers about 23 ft. high connected on top by caps and stringers providing a working platform on which was installed an elevated receiving hopper. This hopper was filled by a chute from the hopper in the hoisting tower and from it concrete was distributed in two-wheel carts, pushed on runways over the tops of the columns to distribute the concrete as necessary to the different columns.

Wall Forms

The partition wall was concreted in 48 ft. sections each made up of panels of the full height of 21 to 23 ft. and 12 ft. long that were handled by a steel gantry traveler. The assembled forms were handled as a unit and were adjustable so that they would also serve for the side walls.

The wall footing was first concreted at the rate of about 25 yd. per hour, taking eight hours for one section of the wall. The wall itself containing 150 yd. was concreted in six hours.

Side Wall Forms

The forms for the upper face of the inclined side walls were made adjustable and were so designed as to use the same panels that were used for the vertical partition or gravity wall. The forms for the undersurface of the inclined side walls were also made in 12-ft. panels integral with the forms for the sides of the

buttresses, the cross section thus making three sides of a rectangle.

The forms were made with adjustable angle iron frames covered with wooden sheeting and were suspended from an unsymmetrical steel tower traveler or gantry running astride of the wall. These forms were made with separate upper and lower portions, the latter being placed and removed last in the cycle of operations. After the concrete was set the form was collapsed by operating turnbuckles and was then transversely withdrawn by tackles attached to the traveler so that it would clear the buttresses when advanced to the next panel. The method of setting them, collapsing them and moving them forward was found very convenient and economical.

The upper edges of both the inner and outer surface panels were suspended by adjustable rods from the top of the traveler and the lower ends were braced to the required inclined position when in service and released and allowed to hang in vertical planes when not in service. The outside panels when in service were held against the hydrostatic pressure of the wet concrete by jackscrews engaging transverse ledgers in vertical planes and reacting against the lower chords of the stiffening truss of the gantry.

The panels on the under surface of the inclined wall slabs were supported partly on the rigid framework for the lower portion of the wall and partly on a suspended truss with the lower end braced in the required position as above stated. The wall forms and those for the roof together with the steel travelers were designed and fabricated by Blaw-Knox Company.

An important item of expense in the form work was due to the very large number of tie bolts that were necessary to hold the high sides against the pressure developed by the wet concrete. These walls were so thin and so high that they could be concreted rapidly and developed unusually heavy pressure before the concrete set. The cost of providing for this pressure was a much larger item of expense than was the cost of moving and setting the forms.

Roof Forms

The groined arches for the roof were concreted on 36 collapsible steel frame forms each of them sufficing for one 16x16-ft. panel. They were sheathed with 1-in. matched and dressed boards. The forms were of course moved parallel with the rows of columns and were set with their sides parallel to the rows and concentric with the columns so that the four sides of the forms were located on centre lines drawn midway between the longitudinal and transverse rows of columns. They were assembled in three rows of 12 panels each, the advanced row being concreted first so that the forms could be stripped and set up ahead while the second and third rows were being concreted on successive days.

The forms were moved by telescopic steel tower travelers mounted on trucks and provided with adjustable arms connected to the framework of the forms which was hinged at the centre. The jackscrews in these arms were first slacked off collapsing the forms, after which the tower was telescoped to clear the forms from the roof, and was advanced to the next panel.

Attorney General of Kansas Begins Action Against Kansas Cement Manufacturers

Richard J. Hopkins, attorney general of Kansas, filed suit recently in the supreme court for an ouster against every manufacturing cement company in Kansas.

The suit is directed against the Ash Grove Lime and Portland Cement Company, of Chanute; the Bonner Portland Cement Company, of Bonner Springs; the Fredonia Portland Cement Company, of Fredonia; the Great Western Portland Cement Company, of Mildred; the Lehigh Portland Cement Company, of Iola; the Monarch Cement Company, of Humboldt; the Western States Portland Cement Company, of Independence.

Charges a Secret Combine

The petition alleges that all the above named defendants have formed a trust contrary to the laws of the state of Kansas for the purpose of creating and carrying out restriction in restraint of trade in the sale and distribution of cement in Kansas.

The attorney general charges that all of the above named companies have entered into a secret agreement, either written or verbal, to sell cement in the state at one uniform price and to add to this price and charge to the purchaser of cement an amount equal to the railroad freight charges, not from the point of production to the point of delivery, but from the city of Iola to the place of delivery. He also charges that the cement companies, in violation of the laws of Kansas, have "intentionally and for the purpose of destroying competition," discriminated between the different sections by selling at a lower rate in one section than it charges for the same cement in other sections, after equaling the distance from the point of production and the points of delivery.

The petition of the attorney general charges further that the cement companies have agreed to divide the territory of the state so that in certain portions of the state companies have the exclusive right to fix the price of cement, below which no other company shall sell cement.

Says Prices Excessively High

Another count against the companies is that they have pooled their interests as manufacturers and sellers of cement so that the price is maintained at a figure excessively and unreasonably high, to the great detriment of the people of the state, and by such pooling have agreed upon a division of their receipts from the manufacture and sale of cement.

The petitions ask that each of the companies named as being members of the trust be ousted from doing business in Kansas and that the franchises be forfeited and surrendered and that all of them be excluded from the exercise within this state of any business and that all corporate acts, franchises and privileges be taken from them and that they be especially restrained from carrying out and continuing to maintain the trust and combination with which he charges them.

Asks for a Receiver

The hardest blow of all, to the cement companies, which the attorney general asks, is that a receiver be appointed by the supreme court to take charge and control, under the jurisdiction of the court, of all the property of all the companies in the combine and further asks that a penalty of not less than \$100 a day be imposed upon each company for every day that they have violated or continue to violate the anti-trust laws of Kansas.

Proportioning Mortars and Concretes by Surface Areas of Aggregates

The subject of proportioning aggregates for concretes and mortars is discussed from a new point of view in a paper presented at the last annual meeting of the American Society for Testing Materials by Llewellyn N. Edwards, supervising engineer of bridge of the Department of Works, Toronto, Ont. Mr. Edwards has developed a method of proportioning which assumes as its basic principle that strength, hardness, etc., of concrete and mortars are primarily dependent upon the relation of the volume of cementing material to the surface area of the aggregate. His paper, an abstract of which is given below, had for its objects the following: (1) To develop information relating to the average surface area of sand and stone aggregates; (2) to describe the methods and materials used, the results obtained, and the phenomena observed in a series of experimental tests undertaken to develop the practical application and efficiency of the method.

The results obtained from the tests are summarized in the paper as follows:

1. That with materials of uniform quality this method provides a means of securing uniformly strong mortars and concretes from sand aggregates of varying granulometric composition.

2. That the strengths of mortars are dependent upon (1) the quantity of cement in relation to the surface areas of the aggregates, and (2) the consistency of the mix.

3. That the strengths of mortars of uniform consistency containing sand aggregates of varying granulometric composition are directly proportional to the quantity of cement they contain in relation to the surface area of the aggregate.

Practical Application of the Surface Area Method.—The adaptation of the surface-area method of proportioning mortars and concretes to both laboratory investigations and to field construction operations presents no serious difficulties. The outstanding feature of this method, in so far as its practical application is concerned, is the importance of knowing the granulometric composition of the aggregates. It must be admitted that the securing of this all-important information involves a comparatively small amount of labor, and by way of equipment the use of only the necessary scales, standard sieves and screens. The time element involved is comparatively negligible, since the computation work of determining areas and quantities of cement can be largely reduced to the most simple mathematical operations by the use of tables and diagrams. For use in the laboratory and in the field, diagrams drawn to a large scale increase accuracy and reduce labor.

Figs. 1 and 2 are designed for use in determining the surface areas of sand aggregate. The former is intended for laboratory uses and the latter for both laboratory and field use. These diagrams are derived from computations made by Mr. Edwards. Fig. 3 is designed for use in determining the surface area of stone aggregate and is intended for both field and laboratory use. Fig. 4 is a conversion diagram for determining the relative quantity of cement in pounds per 100 lbs. of sand from the corresponding relation of cement in grams to the surface area of 1,000 g. of sand and vice versa.

Use of Diagrams.—The following examples explain

the method of using the diagrams shown in Figs. 1 to 4, inclusive:

Example No. 1.—Required to find the composition of a batch of mortar using 1,000 g. of sand A and a cement content proportioned: 1 g. cement to 15 sq. in. sand area.

SAND AREA.

Sieve.	Grading, per cent.	Weight, g.	Area (Fig. 21) sq. in.
P 4-R 8	15.0	150	142
P 8-R 10	5.0	50	75
P 10-R 20	25.0	250	694
P 20-R 30	15.0	150	676
P 30-R 40	15.0	150	997
P 40-R 50	10.0	100	992

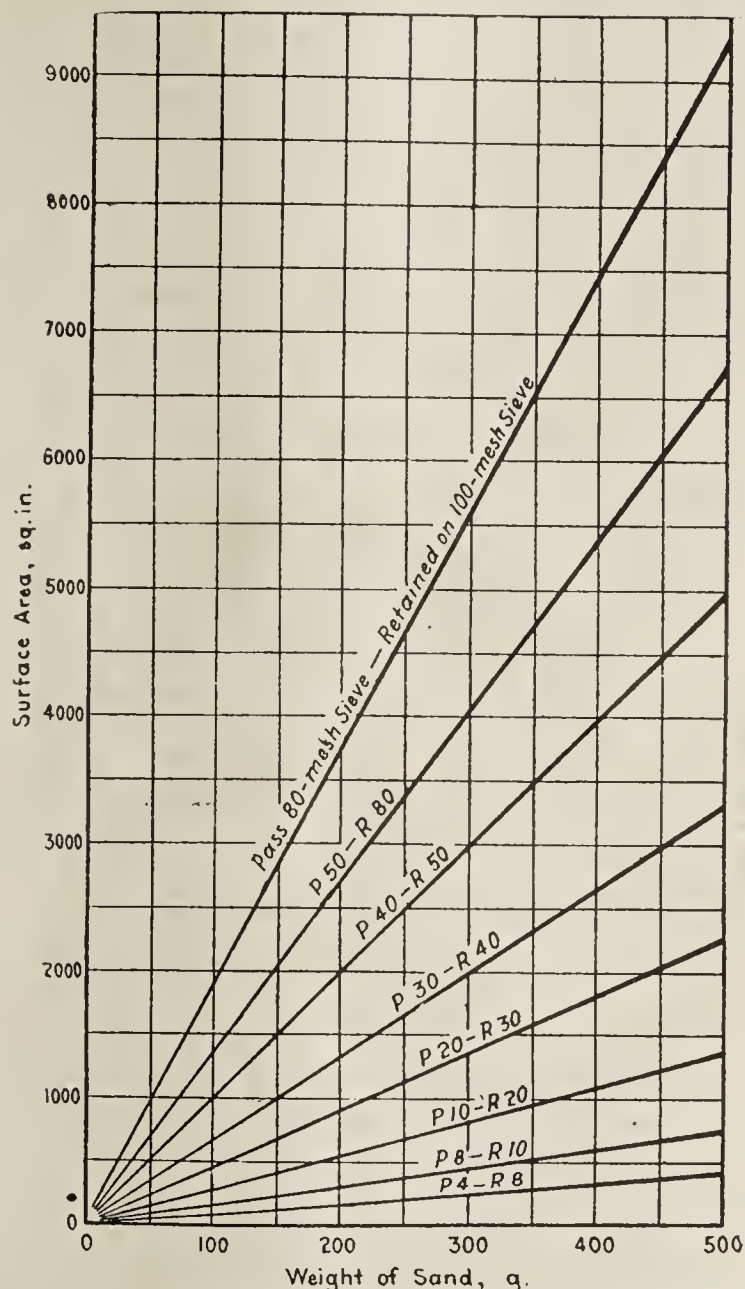


Fig. 1—Surface Area (sq. in.) Corresponding to Various Weights of Sand Aggregate (g.).

P 50-R 80	10.0	100	1,348
P 80-R 100	5.0	50	932
Totals	100.0	1,000	5,856

$$\text{Cement (g.)} = \frac{5856}{15} = 390.5$$

$$\text{Water (cc.)} = \left\{ 390.5 \times 22.25\% \text{ (norm. consistency)} \right\} + \frac{5856}{210} = 115.$$

Example No. 2.—Required to find the composition of a batch of concrete using 100 lb. of sand A, 200 lb. of broken stone graded as shown below, and a cement content proportioned: 1 g. cement to 15 sq. in. aggregate area.

The area of the sand aggregate is determined as shown in Example No. 1 except that Fig. 22 is used, therefore: Sand area (sq. ft.) = 1,845 sq. ft. per 100 lb.

STONE AREA. . .

Screen.	Grading, per cent.	Weight, lb.	Area (Fig. 23) sq. ft.
P 1½ in.-R 1 in.	60.0	120	69.0
P 1 in.-R ¾ in.	25.0	50	41.5
P ¾ in.-R ½ in.	10.0	20	24.5
P ½ in.-R ¼ in.	5.0	10	16.0
Totals	100.0	200	151.0

Total area of aggregates = 1,996 sq. ft.

Cement (lb.) = 19.96 x 2.11 (Fig. 24) = 42.12 lb.

Practical Limitations.—It is especially important to note that in its application the surface-area method of proportioning admits of certain physical limitations. The more important of these are:

Effect of Dust.—The effect upon the physical properties of mortars and concretes of a sandy "dust" passing a No. 100 sieve is not definitely known. The main feature to be considered in this connection is the relation of the sizes of the "dust" particles to the sizes of the cement particles. A microscopic examination of the cement used in the tests described in this paper showed the sizes of the greater portion of the cement particles to range from 1.5 to 3.3 μ .¹ in their largest di-

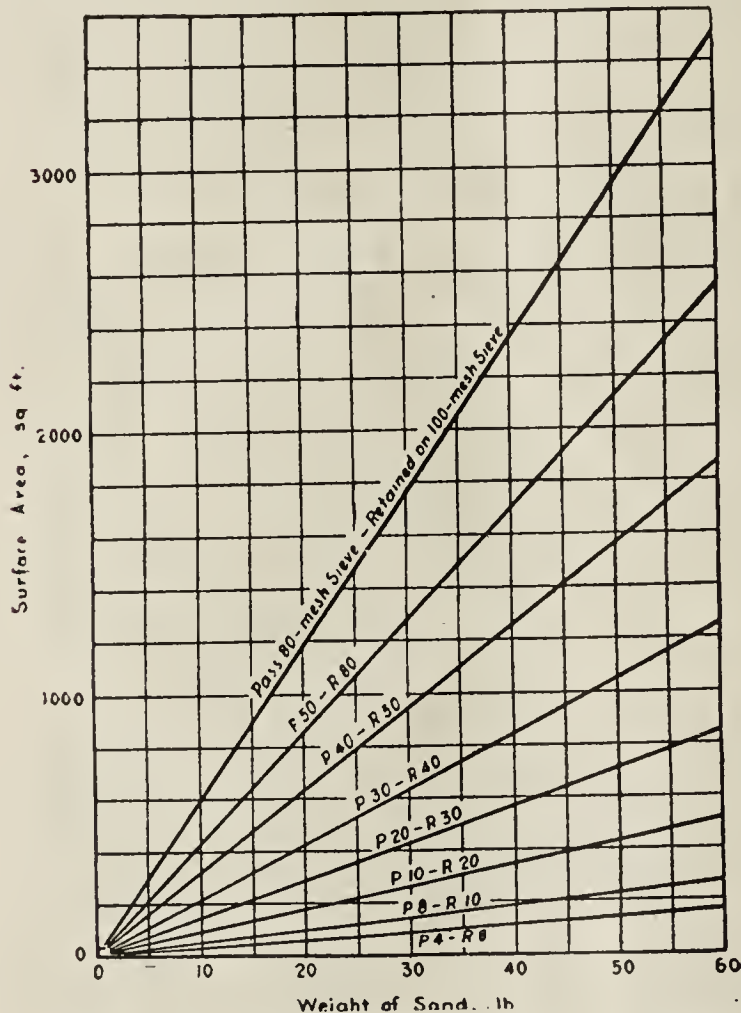


Fig. 2—Surface Area (sq. ft.) Corresponding to Various Weights of Sand Aggregate (lb.).

mensions with an average dimension of approximately 1

2.2 μ , that is, $\frac{1}{11,540}$ in. Some of the larger particles

measured ranged in size up to 6.7 μ .

Disregarding entirely the effect of the surface tension of the water used in the mix, it is reasonable to assume that the particles of dust do not become "coated" with cement paste, but that instead they be-

¹One micron (μ) = $\frac{1}{25,390}$ in.

come linked to adjoining particles of aggregate by one or more separate cement bonds. Doubtless the cohesion existing between particles of cement is greater than the adhesion existing between these particles and the particles of dust or other aggregate. It follows, therefore, that the strength of the mass must be somewhat weakened by the inclusion of dust in the aggregate.

Laboratory vs. Field.—The most important difference between the preparation of mortars in the laboratory and the field is found in the methods of mixing. In the laboratory the operator submits the mix to a thorough kneading and squeezing which forces the component materials into the closest possible contact with each other. In the field the mixing and frequently

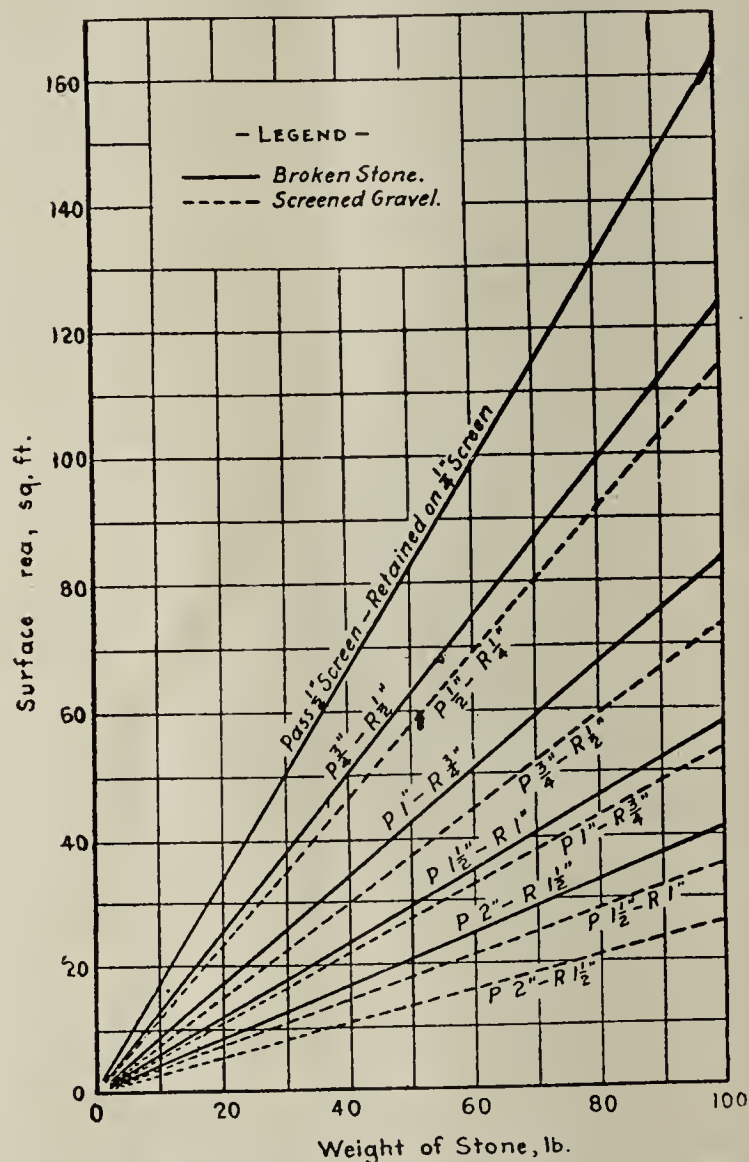


Fig. 3—Surface Area (sq. ft.) Corresponding to Various Weights of Stone Aggregate (lb.).

much of the work of transporting and placing tends to separate and break up rather than to knead and compact the mortar mass.

Field construction conditions are never ideal, even when carried on under the most careful supervision. In consequence, the strengths and other physical properties of field-made mortars and concretes frequently differ widely from the results obtained by tests made in the laboratory, in accordance with standard laboratory practice, with the object of obtaining a measure of the constructive value of the materials.

Coarse vs. Fine Sands.—Mortars in which the sand aggregate contains a comparatively large proportion of coarse particles are subject, during mixing and placing operations in the field, to an intensified movement of the water content which tends to produce an

improper distribution of the cement. This condition is most noticeable in concreting operations.

When mixed to "normal" consistency, so-called well-graded sands do not produce mortars which are as "workable" as those in which the sand aggregate contains larger percentages of smaller sized particles.

As compared with mortars containing well-graded sand aggregate, mortars containing aggregates composed entirely of fine particles must be subjected to a greater amount of mixing in order to secure a uniform distribution of the cement by a thorough abrasion which will separate the fine particles of aggregate tending to cling together.

Wet vs. Dry Sand.—The amount of moisture existing in the sand aggregate constitutes one of the most commonly disregarded sources of variation in the strength of field-made mortars and concretes. Various tests have shown that the surface tension of the water film enveloping the sand particles holds the particles apart, thus producing a decided increase in the gross volume. Sands made up of fine particles, and in consequence having greater surface area, increase more in volume than coarse sands. It is evident that a disregard for this important factor may produce materials the ultimate strength of which are quite different from those contemplated in the design.

Conclusions.—From a careful consideration of the results obtained and of the phenomena observed in the tests the following conclusions appear to be warranted:

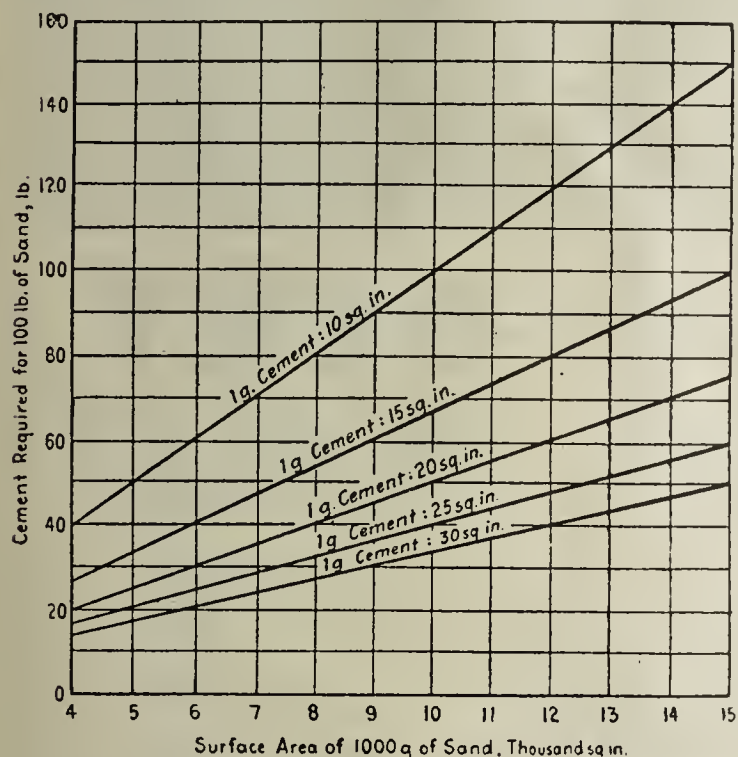


Fig. 4—Weights of Cement (lb.) per 100 lb. of Sand Aggregate Corresponding to Various Surface Areas per 1,000 g. of Sand Aggregate and Various Proportions of Cement to Surface Area.

1. The claim that the surface-area method of proportioning the cement content of mortars and of concretes is essentially scientific and rational is proven by the uniformity of results obtained in comparative strength tests of mortars and concretes and by the phenomena observed in these tests.

2. With a given uniform proportion of cement in relation to the surface areas involved, this method provides a definite and practical means of comparing the relative strength-producing qualities of aggregates of varying physical, chemical and mechanical properties.

3. This method provides a means for a more thorough investigation of the functions of sand and stone aggregates and for a more complete development of the true values of all the component materials of mortars and concretes.

4. Excess water in an over-saturated mortar or concrete mix exerts a decidedly weakening effect upon the cement matrix by producing a change in the physical structure of the matrix which tends to destroy the cohesion between the particles of cement and the adhesion existing between the cement and the aggregate.

5. In a normal consistency mortar the relation of the area of the particles of the sand aggregate to the cement content of the mix determines the strength of the mortar, provided the strength of the sand material is greater than that of the cement matrix. A similar condition applies to concrete mixes not over-saturated.

6. The strengths of mortars containing a given cement and sand but varying for the different mixes in the proportions of these ingredients, are directly proportional to the relation existing between the cement content and the surface area of the aggregate. It follows, therefore, that the strength of a mortar of given mix being known, the mix of a mortar having a desired strength can be pre-determined for the same materials.

7. The quantity of water required to produce "normal," uniform consistency mortars from a given cement combined in varying proportions with sands having the same origin but varying in their granulometric composition, is a function of the water required to reduce the cement to a "normal" paste and the surface area of the sand particles to be wetted.

8. The increase of volume due to the mingling of varying quantities of cement particles with a uniform quantity of a given sand bears no apparent relation to and is evidently not dependent upon the void in the sand.

9. The tests indicate a probable definite relation between the ultimate compressive strength of the mortar content and the ultimate compressive strength of the concrete when the test specimens of the former are produced from mortar of the same mix and consistency as that used in the concrete.

Boss Mixers with Improved Drive

The American Cement Machine Company, Inc., of Keokuk, Iowa, has issued Catalog No. P-20, showing its new line of Boss mixers equipped with the steel roller pinion drive that is described as having a great deal more strength because of its massive semi-steel gear made in two pieces, the pinion being racked with removable case-hardened steel pins and rollers; it is also nearly noiseless, being at least as quiet as cut gears and just as smooth running. One set of rollers and pin are guaranteed for two year. It is further stated that at the small cost of 12 cents a roller one of them can be removed whenever required by merely pulling out a cotter pin, when a new roller may be slipped on the shaft. It is further remarked that the steel roller pinion drive has been used for years on tractors by well-known makers and has proved its great durability and reliability. The book is finely illustrated. Another catalog issued by the same company relates to the Boss hoists and elevators and is of equal excellence. It is No. H-20.

GOODRICH



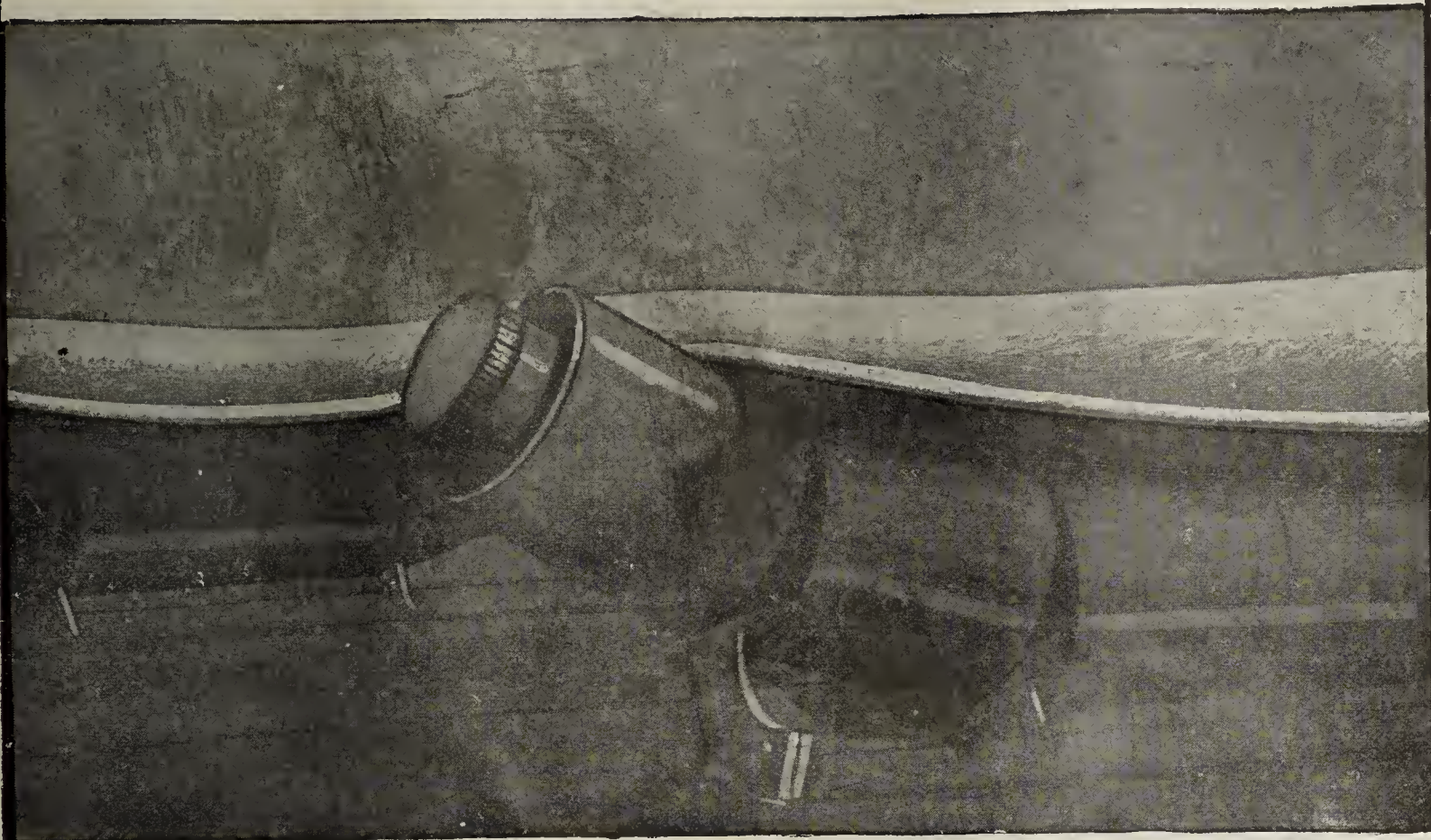
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A Study of Aggregates in Concrete Paving

By R. W. Scherer, Secretary

Concrete as a road surfacing material has come into such universal use that the study of the best method to produce the best concrete has become one of absorbing importance to all highway engineers. At the instigation of cement manufacturers, methods of mixing, laying, curing, finishing, etc., have been discussed at length and to the great benefit of concrete roads. In these discussions a factor has been overlooked which has as great or a greater effect on the wearing qualities of this type of pavement than any one other factor, and that is the shape and uniformity of texture of the coarse aggregates. In the case of crushed gravel, the percentage of crushed angular particles materially affects the durability of the wearing surface, and a comparison of an all pebble concrete with an all crushed stone concrete will show the distinct superiority of angular aggregates, irrespective of their texture.

As in comparing types of pavement it is quite unjustifiable to base general conclusions on isolated cases of failure, so in comparing materials, deductions should not be drawn from a few instances, because there are many other contributing factors, which may vary in different pieces of construction. But in the case of crushed gravel still containing a percentage of round pebbles, comparison is possible in the same piece, where all conditions of mix and traffic be necessarily identical and in such a wearing surface the tendency of the rounded pebble to pit, indeed the certainty that it will "pit," can readily be determined.

And from a wide field of observation on cement roads with both kinds of aggregates comes conforming evidence that this condition is universal—not an isolated case.



Close Up View of Surface of Worn Concrete.

The progress of the pitting of round aggregates is shown in the accompanying illustration, a close-up view of the surface of a concrete road. At A a pebble is seen with most of the mortar above it removed. This is a process which could not occur in an angular stone. When the digging has proceeded down to the thickest part of the stone, the equator as it were, the aggregate readily comes out—again because it is not angular; a jagged corner, or a cubical shape would anchor the piece. At B are shown the cavities left by the removal of such pebbles. The mortar sides of these cavities are readily broken down unless they are in a depression in the surface, and at C the bed of such a pebble is shown with most of the sides removed. An occasional soft or slightly angular pebble will take the wear as at D. At E is shown a hard pebble projecting a half inch above the general surface.

These conditions can be observed on any one course grave concrete pavement that has had sufficient wear to develop the various stages. Eight hundred to 1,000 vehicles per day, even when they are all rubber-tired, will develop the stage shown at A, Fig. 1, in two seasons. Under how much traffic, pebbles begin to be removed depends on the size of the aggregates, but an inch pebble is quite surely displaced after three years of such traffic. The richer mix in the wearing surface of two course work is, of course, an efficient protection against this action.

But in one course pavement the extent of the damage is serious, the durability of the concrete is very seriously affected. In one case, after five seasons, not only was the surface impaired, but the strength of the slab itself was affected by surface wear, as shown in the accompanying illustrations.



Wear on Concrete Surface.

The depression shown in Fig. 2 is actually work away. It is $1\frac{1}{2}$ inches deep. At its deepest point are the cup-shaped cavities of round aggregates that have kicked out. There was every indication on this road that after an inch and a half had worn away the remainder of the slab actually broke through and was pounded to pieces. This condition is illustrated in Fig. 3. The depressed section is about $2\frac{1}{2}$ feet wide and 3 to 4 inches deep. From the "chuck-hole" action the concrete at the bottom of the depression is rapidly being pounded up.

This is the damage in one instance; how common such instances are throughout the country, is only a question of the distribution of gravel concrete six to eight years old and having carried a traffic of 800 to 1,000 per day during the open season.

So prevalent a cause of partial failure in a type of road, deserves the careful study of highway engineers, and we find that while the pitting of round aggregates has been noted and commented on by testing engineers, other explanations are offered besides the characteristic shapes of the aggregates; Profs. R. Agg and Thos. A. McDonald, of the Highway Department of Iowa, in a monograph on an investigation of concrete paving in Des Moines, show several detail views of worn surfaces that reveal the cup-shaped beds of dislodged gravel, but ascribe this action to coated aggregates, to the lack of tamping and to other causes. From the universality of this pitting it is more probable that it is due to some universal characteristic of the aggregate, its shape combined with the water-worn surface.

Laboratory tests, too, agree with observations on actual construction, though it is doubtful whether any existing testing device will successfully imitate the

action of mixed traffic with its steel-tired wheels, horseshoes, rubber tires and pneumatic tires with chains. The testing machine in general use now is the Jones Talbot rattler, and using this in a series of tests Prof. Chas. F. Shoop, of the University of Minnesota, reports that "It was found in the case of gravel specimens that when subjected to the action of the shot, the gravel would kick out and produce pockets and that, once formed, these pockets would quickly develop into holes."

Other investigators ascribe the greater wear on gravel concrete to other causes and there is indeed a contributing factor, in the varying texture of gravel pebbles. In Fig. 1 the pebble marked "E," a piece of hard igneous rock, retaining its hold, and being little subject to wear, projects a half inch above the surrounding surface, producing greater impact on the lower parts.

Prof. J. P. Nash, of the Texas University, using the rattler test, concludes that, "One of the most important factors in road construction is to procure a surface that is uniform and will wear uniformly. Especially is this true with a rigid road such as concrete makes. The surface of most of the gravel concrete was rough. Gravel specimens containing pebbles of varying hardness, produce a surface in which the hard flints wear but little, while the softer limestones wear equally with the mortar. In many cases these flints protrude as much as one-inch above the surrounding surface."

Mr. H. J. Kuelling, under whose direction over a hundred miles of Milwaukee County's concrete roads



A Broken Slab in Concrete.

were built, and basing his conclusions on field observations, states: "The question of uniformity in concrete road materials is becoming more and more important to us—much more important than to have a very good quality of stone or gravel. This, in order to have a uniform wear, for a road, no matter what its make-up, if it becomes exceedingly rough, must have something done to it; whereas, a road built of uniformly soft limestone may last a long time because it will wear uniformly."

There is certainly every reason to believe that shape character of surfaces and uniformity of texture in coarse aggregates materially affect the durability of concrete, and that to give concrete paving the permanence that could reasonably be expected, the use of rounded, water-worn pebbles must be avoided as far as possible, and whenever possible.

Madison Wis., Firm Manufactures Device for Making Concrete Posts

The National Concrete Machinery Company has its office in Suite 509, Bank of Wisconsin building. Its

plant is at 211 South Paterson street. It manufactures National Equipment for making concrete posts and the Toohey Timber Dapper.

The post equipment consists of post machine, molds and reinforcement for posts. The power machine makes posts at the rate of 50 an hour, and is the only device on the market that produces them rapidly and entirely by machinery. Among the railroads using this machine are the Chicago, Burlington & Quincy, Illinois Central, Central of Georgia, Rock Island, Big Four, New York Central.

Post plants have been established in various sections for manufacturing for local trade. This section is supplied by the Madison Concrete Products Company, 700 Block, Regent street, Urban J. Meuer, manager. They manufacture seven, eight and ten-foot posts for line fences, corners, gates, clothes lines, crossing signs and highway markers. Posts may be seen in use at the university farms, Monona Park, Maple Bluff, Mont Joy and any railroad crossing.

Smaller Machine Made

The company manufactures a second and smaller type of machine designed for concerns who wish to make a comparatively small number of posts for their own use for sale.

The National post differs from any other in process of manufacture and reinforcement used. No. 8 Bright Bessemer steel wire is used for reinforcement and spaced one-half inch from the edge of the post, the post being round and tapering. Six strands are used in the regular line fence post. In competitive tests the National shows much stronger than any other post of approximately equal weight.

The concrete post makes a handsome fence, increases property values, is practically everlasting, upkeep is very light, it will not heave, rot, burn, rust or corrode. Its popularity is rapidly increasing.

Make Power Adzing Machine

The company also manufactures a power adzing machine designed and patented by a practical railroad man. It is a complete power driven unit for squaring and dapping stringers, ties, and guard rails used in railway bridge construction. Two men operating this machine will do the same amount of work per day as six skilled adzmen.

The company has been in operation for twelve years. The officers are S. T. Walker, president and general manager; Alfred T. Rogers, secretary and treasurer. Victor E. Rogers, sales manager. The board of directors consists of the officers, Charles D. Ficks and M. H. Hovey.

Frogs, Switches, Special Work, Etc.

Catalog D-4 of the Cincinnati Frog and Switch Company, whose office and works are at Oakley, Cincinnati, Ohio, completely illustrates the various kinds of railway frogs, switches, crossings, switch stands, rail braces derails, tie plates, tie bars, rail braces, fish plates, guards, etc., which it manufactures. The company makes all kinds of special work required for the track equipment of steam and electric roads, portable industrial railways, etc. There are more than 130 pages in the book and the very numerous pictures and diagrams show the frogs, crossings, special work, switch equipment, etc., exactly as they are so that orders can be placed for just such material as a purchaser may need for his particular use. There are also two full-page illustrations of the company's plant, which has direct railroad connections for quick shipment of orders.

Stone-Shipping Dock Is Patterned After Ore-Bin Type

Cylindrical Steel Bins, Loaded from Cars Above, Discharge by Gravity to Steamers—
Capacity 7,880 Tons

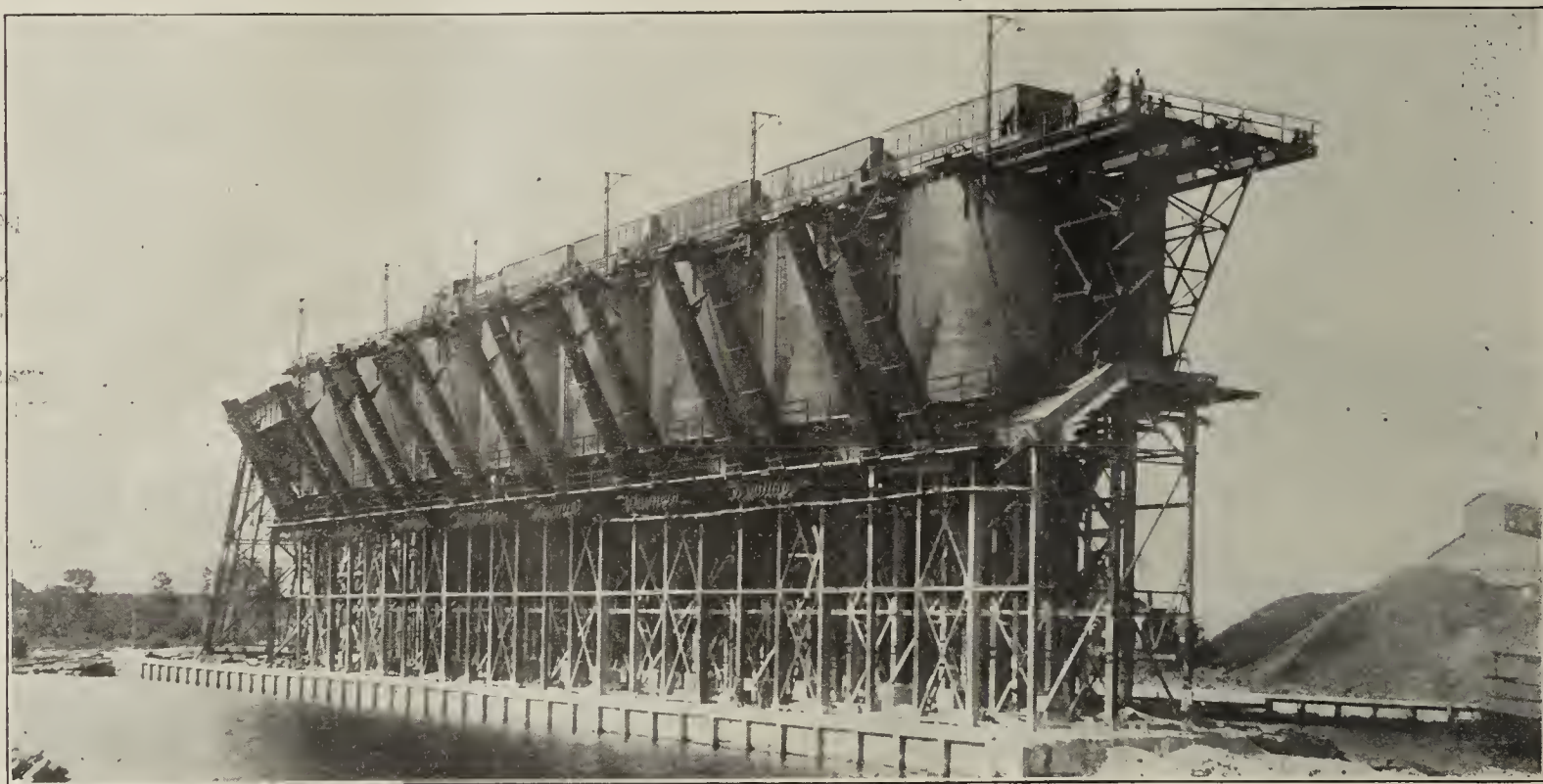
The Michigan Alkali Co.'s dock for storing and shipping broken-stone at Alpena, Mich., is of the bin type generally used at ore-shipping ports on the Great Lakes, but has several distinctive features. It consists of a steel structure carrying a series of bins, over which run tracks for the cars and from which the stone is spouted by gravity to ships or barges. It has spouts on one side only, as the dock forms one side of a slip, on the other side of which is an old timber dock which will be replaced later with a new structure.

The dock, shown by the accompanying view, is 288 ft. long, with eight circular bins of 985 tons capacity, making a total of 7,880 tons. It is on a pier 34 ft. wide, built of cribs which are founded on solid rock and filled with stone and concrete. Anchor bolts for the steel-

sloping portion is protected from wear by a 3-in. wood covering.

The steel framing at the tops of the bents supports four rows of columns between the bins, and upon these are plate-girder stringers with track rails laid upon the top flanges. The space between the rails of each track is open, for dumping the stone from hopper-bottom cars. Between the outside of the tracks is a 3-in. plank deck. Along the front of the bins is a walk giving access to the gate-operating machinery. The steelwork was given two coats of magnetic paint. The interior of the bins is given no special protection against the stone—this not being thought necessary.

A special feature is that the bins are of relatively large capacity, and each is fitted with two doors or gates, thus allowing for more complete discharge of the



Steel Cylindrical Bins are Used for Storing and Shipping Broken Stone.

work were embedded in this concrete. At the shore end is a steel trestle connection to a long earth fill carrying the tracks over which cars are run from the crusher house to the upper level of the dock.

Design of Stone-Shipping Dock

The lower portion of the structure consists of 25 three-post bents 26 ft. wide, spaced 12 ft. c. to c., with diagonal bracing in each third bay. The posts are H-beams, 12-in. for the outer posts and 14-in. for the central posts. The height is about 36 ft. on the shorter side of the bent. The bins are 24½ ft. deep at the rear, where the floor is flat, and 37½ ft. at the front, where the floor is inclined. They are of ½-in. plate for 17 ft. from the top, and thence of ⅜-in. plate. The framing on top of the bents carries a 24-in. reinforced-concrete slab. The rear part of this is flat, while the forward part is inclined 7 on 10 toward the gates, with a ridge or saddle between the two gate openings. This

contents. The large bins reduce the cost of construction and also reduce the maintenance and repair expense for a given capacity. The concrete floor practically eliminates deterioration of the bin bottoms and serves to stiffen the structure, while it also forms a protecting roof over the lower or supporting portion. The two spouts of each bin are 12 ft. c. to c., which corresponds to the standard hatch spacing of lake vessels. As the space between the spouts of adjacent bins is 24 ft., each third hatch is left unserved, and the vessel must be shifted 12 ft. to get its full cargo. This shifting, however, is not objected to by the boat captains.

The use of two doors to each bin makes it possible to reduce the size of the openings so that the flow of stone can be controlled by hand-operated doors. These small doors may be of simple construction. Each opening has a curved or arc gate as shown in one of the drawings, with the convex side facing the bin. On the outer or concave side is a curved rack gearing with a

pinion on a short shaft which also carries a 16-in. sprocket wheel. A riveted pintle chain runs over this sprocket and a 4.3-in. sprocket on a shaft carrying a 42-in. hand wheel. Owing to the curvature of the gate its movement in closing is in the direction of the flow of the stone so that it is easily closed. The gates are operated by men on a platform near the bottom of the bins.

The swinging spouts or chutes are steel troughs about 33 ft. long, 52 to 32 in. wide, pivoted at the heel and having near the lower end a ball attached to a cable. They are of light construction and are counter-weighted, so that the operating power required and the repair cost are very low. The hoists for these spouts are arranged in groups of four. Each group has a line shaft which is fitted with a fraction clutch for each hoist and is driven from a 10-hp. electric motor. By means of a special device, the motor and clutches can be controlled from the operating platform or walk on top of the dock. This enables one man to operate any of the four chutes from any part of the platform directly above the group, and at the same time to keep control of the motor.

Book Reviews

CONCRETE-STEEL CONSTRUCTION. By Henry T. Eddy, C. E., Ph. D., Sc. D., LL. D., and C. A. P. Turner, C. E. Part I, section edition. Single volume, 473 pp., index 4 pp., appendix 25 pp.; illus., with half tones and line drawings. Cloth, 6¾ x 9¾. Published by C. A. P. Turner Co., Minneapolis.

Devoted to building construction, this book seeks to bridge the gap between theory and practice. There are 25 chapters and they deal with the following sub-topics: Concrete, general types and concrete floor construction, mechanics of stress, mechanics of permanent deformation and strain beyond the limits of elasticity, the chemical and mechanical energy of hardening of Portland cement and work performed by it, simple beams, restrained and continuous beams, indirect stresses generated by bond shear and their laws of distribution, deflection and mode of operation as shown by contour lines and distribution of reactions and moments as shown by lines of zero, shear, the continuous uniform slab of separated supports under uniform loading, reinforced concrete columns, unbalanced moments in monolithic floors and columns, experimental verifications of the theory of flexure of concrete members, foundations and elements of economic construction and cost of reinforced concrete work.

The introduction of concrete is noted and the progress in its use is reviewed. The departure of the early concrete builder from old forms of construction, it is explained, required the development of a new theoretical treatment based upon a broader application of the ordinary principles of equilibrium.

The effort of the authors, it is said, "is to elucidate the harmony existing between correct theory and scientific practice, and disclose the error of commonly accepted methods of computation of applied bending moments by showing how unwarranted is the assumption that the statical moment about any section in a plate is all pure bending moment, instead of being a combination of applied bending and twisting moments as treated by Thompson and Tait in their treatise on Natural Philosophy."

The authors have sought to avoid higher mathematics and to retain simplicity as far as possible.

Application of Stuccos

Interesting information on the application of portland cement stucco was given in the report of the Committee on Treatment of Concrete Surfaces, submitted last month at the annual meeting of the American Concrete Institute. The following is abstracted from the report:

The use of hair, lime, and waterproofing materials, the variations in the mixtures for the different coats, the number and thickness of the coats, the intervals between the coats, the degree of wetting of the undercoats, and the precautions necessary in protecting the coats from too rapid drying, are details subject to question, and all will stand further investigation. However, the study of the experimental panels at the Bureau of Standards has yielded considerable information on some of these points.

One of the most important indications from these panels is that lean mixtures containing well graded aggregate give better results than those commonly specified. Mixtures as lean as 1 part of cement to 6 or 7 parts of graded aggregate have given excellent results in these tests. The committee is of the opinion that the volume change of rich mortars is accountable for much of the unsightly cracking of stuccos, and that no mixture should be used in which the proportion of cement is greater than 1 part to 3 parts of fine aggregate.

The effect of hydrated lime in cement stucco has also been given considerable attention, and the conclusion which is forcing itself upon the committee is that hydrated lime does not improve the structure of the stucco, but by imparting better working quality to the mortar, reduces the cost of application. On the other hand, there is evidence that not more than 20 per cent of hydrated lime, by volume of the cement, should be added to cement stucco if the best results are to be obtained.

There seems to be no good reason for varying the composition of the different coats, but if a variation is to be specified, the scratch coat should logically be the strongest mixture followed by a leaner brown coat, and a still leaner finish. No greater mistake has ever been made in stucco application than the use of a strong brown coat over a weak base or a weak scratch coat. The not uncommon practice of applying a strong brown coat over a lime mortar scratch coat has been responsible for many stucco failures.

The suggestion that the finish coat should logically be leaner than the undercoats immediately brings up the waterproofing question. They are two fundamental points to be considered in this connection; first, that the lean coat is not necessarily lacking in density, and second, that the waterproofing problem in good cement stucco is not one of overcoming permeability, but rather of reducing absorption. The entire question hinges on absorption, and the evidence at hand indicates that a moderate degree of absorption is a much more preferable condition than a surface covered with craze and map cracks produced by the use of a too rich or wrongly manipulated finishing coat. Any waterproofing treatment that alters the natural texture and color of the stucco may be dismissed from consideration, and the merit of any integral waterproofing in stucco is exceedingly difficult to determine.

The question as to number and thickness of coats may be best answered by assuming that each coat of stucco has its own particular function. The scratch

coat is the first applied, and its purpose is to form an intimate bond and a secure support for the body of the stucco. On metal lath it also serves as a protective coat, and it should therefore be strong and not too lean. The use of hair or fiber is of questionable value. Hair or fiber should not be used when the space back of the lath is to be filled, and is probably not a necessary ingredient in any case. The committee at the present time would sanction its use only in scratch coats on wood lath, or on metal or wire lath that is to be back plastered, or on metal or wire lath that is applied over furring deeper than $\frac{3}{8}$ in. The thickness of the scratch coat should average about $\frac{1}{4}$ in. over the face of the lath.

The function of the second coat (commonly called the brown or straightening coat) is to establish a true and even surface upon which to apply the finish. It forms the body of the stucco, and must fill the hollows and cover the humps of the scratch coat. For this reason an average thickness of $\frac{3}{8}$ in. to $\frac{1}{2}$ in. will usually be required. The brown and finish coats, or the scratch and brown coats, are sometimes combined up two-coat work, which is permissible when the base upon which the stucco is applied is fairly true and even, or, when on account of cost considerations, the best obtainable finish is not required. It is difficult, however, to obtain a satisfactory finish on a coat which runs $\frac{1}{2}$ in. or more in thickness, since the tendency of a heavy coat to bag and slip is likely to produce an uneven surface.

The finish coat serves only a decorative purpose and has no structural value. Its function is solely to provide an attractive appearance, and any mixture or any method of application that may detract from the appearance, or in any way injure the permanency, should be avoided. Herein lies the argument for lean mixtures, which are more likely to be free from unsightly defects than rich mixtures, and are also more likely to improve in appearance under the action of the weather. The finish coat should be as thin as possible consistent with covering capacity, and may vary from $\frac{1}{8}$ in. to $\frac{3}{8}$ in. in thickness, depending upon the type employed.

It is obvious from the foregoing that first-class stucco should be 3-coat work, each coat serving its own particular purpose. The bond between the brown coat and the scratch coat needs to be strong in order to carry the weight of the body of the stucco, and for this reason it is now considered preferable to apply the brown coat the day following the application of the scratch coat. Except in dry or windy weather little wetting of the scratch coat should be necessary when the brown coat is to follow within 24 hours. A slight degree of absorption of "suction" in the scratch coat, is probably better than complete saturation, for the brown coat, as well as the others, is necessarily mixed with a larger quantity of water than it requires for maximum strength. The removal of a portion of this excess water by the suction of the undercoat not only improves the quality of the coat, but also insures a better bond by tending to draw the fine particles of the cement into the pores and interstices of the undercoat.

Whereas the interval between the brown coat and scratch coat, as recommended above, is relatively short, the interval before applying the finish coat should be as long as permissible under the conditions of the work. The reason for thus delaying the application of the finish is to enable the body of the stucco to obtain its initial shrinkage and a nearer approach to its final

condition of strength and hardness, before being covered with the surface coat. The bond of the latter needs to be intimate rather than of maximum strength, and if the body of the stucco has been allowed to thoroughly set and harden, it may be assumed that the finish coat is less likely to be disturbed by subsequent volume changes in the undercoats. A week or more should elapse between the application of the brown and finish coats.

The finish coat should be applied over a damp, but not saturated, undercoat, for excess water is likely to injure the bond seriously. Certain types of finish, such as wet mixtures used for sand spraying, or for the "spatter dash" finish, may preferably be applied to a fairly dry undercoat, since suction must be depended upon to prevent streakiness and muddy appearance. The fact that finishes of this type applied in this manner may set and dry out with little strength is not serious; they gradually attain sufficient hardness with exposure to the weather.

Curing of the undercoats by sprinkling, and protection of finish coats against sun, wind, rain and frost by means of tarpaulins are always to be recommended. This is not always feasible, however, and the architect should be content to specify and insist upon reasonable precautions. The application of cement stucco in freezing weather should be avoided, and in fact temperature slightly above the freezing point may allow frost to form on a damp wall. The application of stucco under such conditions is likely to result in failure.

Strength of Concrete Increased by Rodding

The strength of concrete is much impaired if entrapped air and excess of water are not given some artificial means of escape while the material is setting. The process called "rodding" is the most effective. An iron rod worked up and down in the mixture makes passages which provide an exit, the operation being repeated until the material is too firm to permit its continuation. Experiments have been made with concrete containing about six sacks of cement per cubic yard mixed with about 10 per cent of water, and the result showed an increase of 100 per cent in strength. A laboratory test was also made, showing that, after seven hours of the treatment, specimens of concrete developed enough strength in twenty-eight days to resist a weight of 4,644 pounds per square inch, whereas exactly similar specimens of the same age, which had not been rodded could not resist a weight of more than 1,962 pounds.

Blasting Concrete Economical and Safe

Contractors having to demolish old structures of brick, stone, concrete, etc., will be interested in the economic possibilities of blasting concrete with explosives as described in an illustrated article published in a booklet by E. I. du Pont de Nemours & Co. Explosives are now employed for demolishing walls, foundations, piers, engine beds, etc., when it becomes necessary to clear away such work. It is shown how this use of explosives can be done even within a building if necessary, and with perfect safety, a special explosive of comparatively slow action being provided. Much time is saved as compared with breaking up by hand.

The Manufacture of Cement at Bellevue, Mich

By C. M. Wright

For the past eight years the Burt Portland Cement Company have been closing down on Sundays in order to give their men a rest, do better work, be better satisfied and get more out of life.

After long and careful experiments it was found that the best way to shut down the kiln, and one which did not harm the lining in the least, was to shut off the fire and stop the kiln, with its full load, simultaneously; then for a period of three hours to give the kiln part of a revolution three or four times an hour.

Upon starting up, the heat was turned on full blast and the kiln turned a part of a revolution three or four times during a period of an hour. Then the kiln could start to turn normally and the process go on.

In giving the kiln the partial revolutions during cooling and reheating, only a few wheelbarrow loads of clinker would be discharged. The only actual loss of heat occurred during the reheating process. There was absolutely no warping or damage to the kiln.

So this method was adopted for all of the kilns and has been followed ever since.

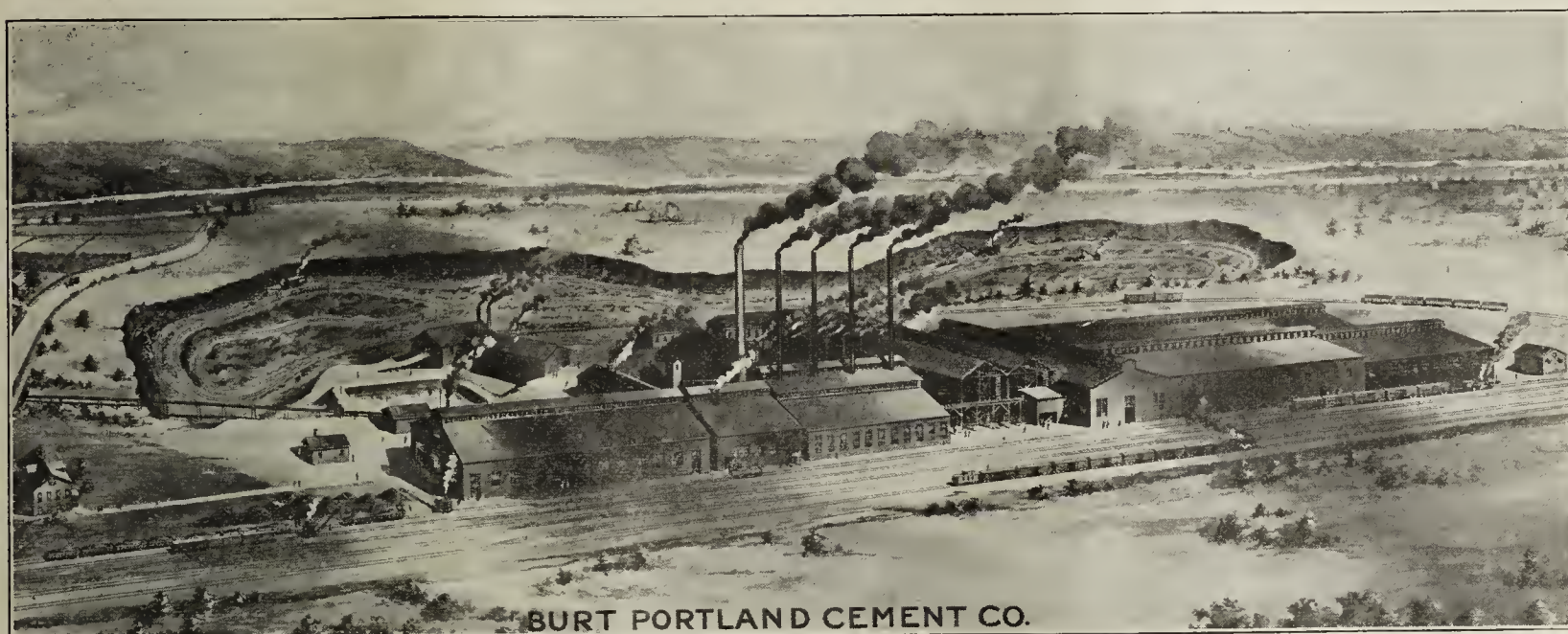
The effect upon the men was also manifested early. At the very first, the decreased pay was objected to, but after a few weeks there were none willing to return to the seven-day week. In many instances men have left positions paying more money to come to this plant, in order that they might have their Sundays as other people do.

The plant has a normal output of about 2,000 barrels a day with a full crew of 165 men. And one finds these men a contented lot, many having been with the company for years.

Last year, during an excessively hot period, the whole plant was shut down for a period of ten days, with all the men on full pay. A house was fitted up in the village as a sort of club, with baths and recreation rooms for the use of employees.

The manner of mixing the raw material after it comes from the ball mills is an interesting feature at this plant. This is done at twelve bins in the storage house, laid out and numbered.

Eight of the bins, numbered 1 to 4 "Center" and 1 to 4 "East" receive the raw stock from the elevator.



BURT PORTLAND CEMENT CO.

At 6 o'clock Sunday morning the plant is shut down. One small generator in the power plant is kept in operation and supplies power for turning the kilns during cooling. One reliable man sees to this.

The fires under two boilers are kept banked and are freshened up to 5 o'clock Monday morning, and a supply of steam sufficient to begin turning the kilns during starting is ready. As before, one man attends to the starting and when the 6 o'clock whistle blows the kilns are all ready for immediate full operation.

The total amount of coal apparently lost, by careful calculation, is 625 pounds per kiln or 5,000 pounds for the eight kilns—about that required for a half an hour's normal operation. And not all of this is actually lost, for it has been found that the kilns turn out more clinker in the six days of operation than would be turned out in six days of operation under the seven-day rule.

This is in part due to the fact that repairs of a serious nature, which would affect the output of a whole department may now be made on Sunday, and as the whole plant operates as a unit, without excess output in any department, the actual efficiency of the kiln department is slightly increased by more continuous operation during the six days.

This stock is sampled by a continuous automatic sampler as it goes into the bin. The average of these samples is tested every three hours and the calcium carbonate determined for the corresponding number of ball mill hours as shown by record cards 4-E, 1-C, 4-C and 2-C.

From an average sample an analysis is made of the contents of each raw storage bin and the SiO_2 , Al_2O_3 , Fe_2O_3 , CaCO_3 and MgCO_3 determined. Also, by Mayberry's system the "value," positive or negative, is given to each bin.

In mixing the material for the mixed-stock bins it is now only necessary to draw from such raw-stock bins as have "values" which when added together will make zero or, at most, a very small fraction of a point.

Three bins are generally drawn from at once. Sometimes the chemist, by scanning his records, can select three bins whose values will neutralize, so to speak, by drawing equally from each bin. But more often it is simpler to draw faster from one or two bins.

Utilization of Waste Heat

On a balcony in the kiln house are installed four 340-hp. water tube boilers which utilize the heat from the kilns, which would otherwise be wasted. In designing this installation no effort was made to make

steam generating units out of the kilns, but simply to make steam from the heat which would pass to the stacks.

So well did the plan work out that 50 per cent of the power required for the operation of the plant is generated by these boilers.

The gases from two kilns are passed to each boiler through a gas duct which takes the place of the ordinary furnace. The steam is piped 250 feet to the power house. The regular boiler plant in the latter consists of five boilers of 340 hp. each, but it is seldom that more than two of them are in use at one time, although the reserve capacity is there, in case of emergency, to operate the whole plant.

The heat from the clinker pit is also utilized, by drawing the air for the kilns out of the pit by means of a fan, the kiln supply being thus pre-heated to a considerable degree.

Aging the Clinkers with Water

What they are really doing in this plant is to age the clinker instead of the cement, as is done in many plants. Water is sprayed on the hot clinker at the elevator before it goes into the storage bins.

This has more than one point of advantage. In the first place, by very careful regulation, the correct amount of water is added to the clinker to bring about that peculiar chemical reaction, known generally as aging. Ordinarily this action takes place in the cement itself, through absorption of a certain amount of water from the atmosphere. This requires greater cement storage capacity to insure that all the cement be properly aged regardless of fluctuation of demand.

By wetting the clinker the aging is done almost in a moment, and the cement produced is ready at any time for shipment.

The wetting has another advantage, in that it breaks up the clinker as it comes from the kilns and so saves considerable grinding. As the water strikes the hot clinker there are numberless tiny explosions and the pieces are shivered into fine particles. From the clinker storage, 25 per cent of fines are screened out and passed around the ball mills direct to the tube mills, which is a saving directly resulting from the breaking up of the clinker by water.

The water used for this purpose is all measured by a meter which is read several times a day. A record is kept of these readings so that the exact amount of water per kiln-hour can be ascertained. This quantity is kept as uniform as possible and just sufficient to age the clinker without getting it wet enough to interfere with the grinding.

Repairs to Plant Equipment

A machine shop with more than ordinarily complete equipment is a feature of the plant. It contains lathes, a planer, drill presses, hacksaws, emery wheels, bolt machine, oxy-acetylene welding equipment, etc.

All ordinary repairs are made in this shop and spare parts for machinery are constantly being made and put in stock.

A little wrinkle to facilitate repair work has been instituted, in the form of blue print diagrams of the complete driving equipment of each department, which are tacked up in prominent places. Every shaft, gear, pulley, motor, chain and belt in the department is indicated and numbered on the diagram. This greatly facilitates matters when an order comes through to make repairs or replacements on any part of the equipment. By a glance at the diagram the machinist can determine the exact location of the part to be repaired and go to it at once. This would not be possible in all the labyrinth of belts, chains and shafts without some kind of a guide.

Record System

Like other cement plants, elaborate records are kept showing the hours each and every piece of equipment is in operation, the quantities of material passing at every stage of the process, and the exact combination of these materials. This, of course, is very closely tied up with the department of the chief chemist, C. H. Denman.

In connection with the mill records, however, there are some features that indicate a closer analysis than is common in plants of this character.

For one thing, an exact record is kept of every shaft, gear, pulley, belt and chain in the plant, in easily accessible form. We found it interesting to foot up the exact quantities of belting and chain, for instance.

A plant of 2,000 barrels per day cannot be considered large, but it developed that, for machinery drive alone, almost exactly a mile of belting is required, ranging from 2 to 18 inches in width. Add to this the conveyor belts, and we arrive at the total of 6,771 feet.

Much of the drive is by manganese steel chain.

Close record is kept of the life of belts, gears, etc., the repairs necessary, and prices. These records are all kept in card form.

Electrical Features

The generation of steam for power purposes has been taken up before. Electrical power is developed by one 750 K. W. Westinghouse generator operated by an Allis-Chalmers engine and another similar unit of 350 K. W. capacity. The current generated is 440 volt, 3 phase, 25 cycle. Exciting and lighting current are generated by 75 K. W. D. C. unit.

There are 58 motor installations ranging from 10 to 125 hp., the latter for the large crusher. Most of the machinery is driven by individual motors, although there are instances of group drive from a common shaft, as in the case of the dryers. The motors are principally Westinghouse.

All electrical repair work, rewinding of stators, re-insulating of rotors, etc., is done by the chief electrician's force in a special shop building for the purpose.

Quarry and Clay

The limestone deposits in the state of Michigan, which are suitable for cement making, lie in the form of a sort of basin. In the northern part of the state, the outcroppings are more evident. In the middle and southern portions the limestone lies mostly too deep to be available. There is a slight outcropping around Bellevue, about the only place in the southern part of the state where the deposit is workable. At the Burt plant it comes practically to the surface and the overburden is hardly more than 4 inches to a foot in thickness, easily removed with scrapers. There is rock enough right around the plant for another fifty years at the present rate of operation, the company owning several hundred acres.

The rock as it is quarried contains some clay, but this is suitable for the mix and does not have to be removed. The rest of the clay, to further increase the alumina content, is dug from a pit four miles away and brought to the plant by two motor trucks, operating with trailers.

With two trucks (loaded) and two trailers, seventy tons of clay can be transported in five trips. Both trucks and trailers are equipped with steel tires.

In the quarry two steam shovels are operated, one 10-ton with 1½ yard dipper, and one 80-ton with 1¼ yard dipper.

The rock is dumped into cars, thirty in number, of five yards' capacity. The trains are drawn by a small locomotive. The clay is also dumped from the trucks at the edge of the quarry and loaded by gravity into the same cars.

Mining Molding Sand

Six wheeled scrapers coupled together in train were loaded and hauled by a gasoline tractor last summer in mining molding sand near Burlington, Wis. The haul from the pit was one-eighth mile to a bridge over the loading track where the scrapers dumped through a trap into cars. An evener was fitted across the back of each scraper, and the tongue of each was cut off about one-third. When coupled tongue to evener a space of 8 ft. was left between the scrapers. In operation, four to six scrapers were coupled in tandem, with the forward scraper coupled to a tractor geared to three speeds.

The train was hauled through the pit at low speed, and two men loaded the scrapers one after another. Travel to the dumping bridge was at middle speed, and return, unloaded, was at high speed. At the bridge, dumping devices automatically tripped and righted the scraper bodies. Travel to the dump was at a speed one-third faster than team haulage, and return to the pit was at twice the speed of teams. With a haul of one-eighth mile and a force of four men, four to five coal cars of ordinary size, about 35 cubic yards each, were loaded in ten hours. Previously, the same outfit of scrapers required from 15 to 18 men and three teams

time at the Chicago headquarters. E. L. Cox, who has been sales manager since the days of the old German-American company, will remain in his present position.

The statement mailed out by the company is as follows:

"The La Salle Cement Company has acquired all the assets and property formerly owned by the La Salle Portland Cement Company of La Salle, Illinois.

"The board of directors of the new company has elected Mr. C. A. Irvin as president and general manager and Mr. W. E. Viets as secretary and treasurer.

"Mr. E. L. Cox will remain with the La Salle Cement Company as sales manager.

"Mr. Irvin has had eighteen years' experience in the cement business, and under his supervision every effort will be made to bring the plant and general business policy of the company to the highest standard of efficiency, thereby enabling us to render the best possible service to all purchasers of owl-cement."

Opens Chicago Office

William B. Scaife & Sons Co. of Pittsburgh announce the opening on July 1, of a Chicago sales and engineering office at 38 South Dearborn St., with Charles F. O'Hagan, formerly chief engineer of the company at Pittsburgh, as resident engineer and manager. This company, it is said, is the oldest manufacturing concern west of the Allegheny mountains. During the more than one hundred years since their business was founded they have from time to time,



Tractor Operates Train of Wheeled Scrapers in Gravel Pit.

to accomplish the same task. The tractor scraper outfit was originated by the Walsh Sand & Gravel Co., Burlington, Wis. James Walsh devised the method of coupling the scrapers and also the automatic dumping devices.

La Salle Cement Company New Officials

Announcement of the new officials of the La Salle Cement Company, La Salle, Ill. which recently took over the holdings of the former La Salle Portland Cement plant, is made in a circular now being mailed out by the company.

C. A. Irvin has been chosen as president and general manager of the concern, with W. E. Viets as secretary and treasurer. Although their plans are not complete, it is expected that they will spend two or three days a week at the La Salle office, the remainder of the

as conditions arose, added to their manufacturing facilities, so that they now manufacture black or galvanized, riveted, brazed or welded steel tanks for air, gas and liquids; steel shipping drums, range boilers, steel structures; also the well-known We-Fu-Go and Scaife water softeners and filtering equipment.

Ring Pulverizers for Limestone, Coal, Etc.

Two interesting bulletins have been issued by the American Pulverizer Co., 18th and Austin Sts., St. Louis, Mo., one of them being devoted to the ring pulverizer made at this factory, these being especially valuable for grinding limestone for agricultural uses, while the other relates to coal crushers, also of the ring type. Each bulletin is adequately illustrated and contains much valuable information.

Fort Dodge Cement Plant to Double Capacity

The Fort Dodge Portland Cement Corporation has decided to increase the capacity of its cement plant at Gilmore City, Iowa, to more than double its present size, as outlined by M. J. Nicholson of Fort Dodge, president of the company.

At a recent meeting of its board of directors the company determined to double the plant capacity to take care of its rapidly growing business and also to keep pace with the unprecedented demand for cement throughout the entire northwest. It was voted to increase its preferred stock holdings to an additional issue of \$75,000. The recent action of the board places the capitalization at \$3,500,000.

"Never before in the history of the cement industry has there been such a demand for the product of our plant," explained President Nicholson, in announcing the new plans of his company.

"Owing to the inactivity of construction due to the war, there is a remarkable deficiency in building in all parts of the northwest.

"Added to this, is the big impetus to the trade, due to the renewed activities in paving and hard surfacing of roads, all of which causes the country to face a shortage, not only of cement, but also of facilities to manufacture it. We have at our plant contracted for trainloads of cement to be delivered to Hartley, Logan, Mapleton and other Iowa points for paving contractors, and all over our territory the demand has been so strong that today every bit of our surplus stock of cement, and all we can make in the next six months, has been sold.

"At Lusk, Wyoming, where a big boom is now on, a new city is being practically built entirely from Gilmore cement. In fact, our territory lies to the north and west, a part of the country where no cement mills exist, and consists of all northern Iowa, South Dakota, Nebraska, most of Wyoming and portions of Montana. Recent freight rate adjustments have been unusually advantageous to the local plant."

The plans for several new buildings, more machinery and additional facilities, are being rapidly completed and it is expected that actual construction work will be started in the near future.

Egyptian Cement Company Resumes

Operation of the New Egyptian Portland Cement company's plant near Fenton, Michigan, has been resumed by a syndicate headed by John G. Gillespie, former Detroit police commissioner, which recently acquired the property from the Security Trust Company receiver, after purchasing the company's stock and settling with the cement company's general creditors on the basis of 27 cents on a dollar. It is announced that within a few days the company will be turning out its maximum production of 1,400 to 1,500 barrels of cement daily.

With the large volume of road and building construction under way in Detroit and Michigan, the resumption of the plant's operations is expected to give material aid in reducing the shortage of material.

E. R. Sullivan, formerly with the Peerless Cement Company, Union City, Michigan, has been made general manager of the New Egyptian Company and its offices, formerly in Detroit will hereafter be at the plant, which is on the shore of Silver Lake, two miles west of Fenton on the Grand Trunk Railway.

The company's property includes about 800 acres of marl land, which is said to be equal to any in the state.

Before resuming operation, the new management gave the plant a thorough overhauling, expending many thousand dollars on improvements and renewals. The company's capital comprises \$500,000 in stock and \$200,000 in first mortgage bonds.

The Security Trust Company was appointed receiver of the New Egyptian Portland Cement Company by Judge A. J. Tuttle in the United States district court in April, 1918, following the filing of a bill of complaint by one of the creditors. The company had experienced much difficulty in the winter of 1917-1918 due to coal shortage and government restrictions which made it difficult to obtain other supplies.

In the spring and summer of 1918, cement production was greatly curtailed by government restrictions and the company's business fell off to such an extent there was no inducement for any purchaser to take over the plant from the receiver to resume operations. The improvement in business following signing of the armistice and removal of government restrictions, developed an active demand for cement which made it possible for to interest capitalists in the concern.

Paying Wages Through a Bank Account

Not long ago the manager of a big industrial plant in England saw several hundred of his employes crowded around the paymaster's window, drawing their wages. It struck him that this was not only a waste of their time, but that it was an undignified scramble for the money they had earned. He would not have liked to get his own salary that way. It seemed as though a more modern method of paying wages might be contrived.

Going back to his office, he worked out a plan that combines dignity, time saving and thrift. This has been approved by the company, and is now optional with employes, many of whom are taking advantage of it.

Instead of asking employes to congregate around the pay window and wait their turn, they may open a checking account at any bank selected by themselves, and the company deposits wages each week to the employe's credit, in his own bank. The employe then pays household bills by check, draws out whatever cash is needed, and leaves the balance in the bank as savings. The company makes a further contribution to his account representing about 5 per cent interest on all the money which he is able to save.

Before the war, a dollar belonging to an employe and a dollar belonging to the employer were seldom on speaking terms. They represented two entirely different kinds of money and had no association with each other on the employer's books, nor ever combined for teamwork.

But war finance broke down this "class consciousness" between the two dollars. When employes bought Liberty Bonds or pledged themselves to take a certain number of Thrift Stamps weekly, the employer volunteered to do the accounting, deducting bond payments from wages and slipping Thrift or War Savings Stamps into the pay envelope. This brought a new viewpoint to both parties. The wage earner often saved money for the first time in his life, and the employer felt that thrift had a stabilizing value in his work force. That was a value worth paying for, and presently the employer was adding money to employes' savings in the form of additional interest or a bonus. Now the idea is being carried further, as in this English plan of paying wages, extending decent banking facilities to wage earners.

For lack of a checking account, hard-earned money is often frittered away, stolen, lost or handed over

to fraud promoters. But any man or woman who banks money and pays bills by check, and accumulates savings for investment soon learns to manage money matters skillfully. The common distrust of banks disappears. The banker's counsel is sought in matters of investment. There is an improvement all around.

Book Reviews

Sewage Disposal. By Kinnicutt, Winslow and Pratt, Second Edition, Cloth 8 vo. pp. xvii+547. John Wiley & Sons, New York, Chapman & Hall, Limited, London.

Professor C. E. A. Winslow, of Yale University and R. Winthrop Pratt, Consulting Engineer of Cleveland, Ohio under date of 1919 have issued a second edition of the book on Sewage Disposal, published by the late Leonard P. Kinnicutt and themselves in 1911.

A comparison of the present with the previous edition readily convinces one that the authors have been successful in their effort "to rewrite the last edition completely so as to bring in new data and recent view points in connection with all the topics treated." In each chapter changes involving the addition of new text and illustrations, the omission of subject matter and illustrations, rearrangement of content for more logical presentation, or the addition of new sub-topics are frequent and aid materially in increasing the usefulness and value of the book.

The more important changes include the following: The incorporation, as a part of the text of the new edition, of the introduction of the first edition in chapter one; the emphasis of the treatment of manufactural wastes and of bacteria in sewage; the emphasis of the problem of dispersal of sewage in chapter two; a more extended treatment of screening in chapter three; a more lengthy discussion of sedimentation in chapter four; the introduction of subject matter dealing with the Miles Acid process and a much needed word on the cost of electrolytic treatment in chapter five; the formation of a new chapter on Preliminary Treatment of Sewage in Two-Story Tanks, part of the subject matter being taken from the previous edition and much new material being added; the addition to chapter eight of a short description of the Moscow sewage farm, in addition to those described in the first edition; the introduction of a chapter on Treatment of Sewage by the Activated-Sludge Process dealing with the history of the process, and supplying information made available as a result of the work done in Brooklyn, Milwaukee, Cleveland, Houston, and Chicago; the emphasis, in a new chapter, of General Considerations in Regard to Design and Operation of Sewage Treatment Plants, and the inclusion of a chapter dealing with the proper Disposal of Sewage and Excretal Wastes in the Absence of a Sewerage System.

The work has been so well rounded out in the present revision as to make it of much value to those who desire or require a comprehensive view, in relatively small compass, of the changes occurring in each method of treatment and of the question of proper design to obtain satisfactory results with each type of plant, though no attempt has been made to give such detailed information as would apply to sewages of varied character and composition.

Jaeger Concrete Machines

The full line of Jaeger concrete mixers, power loaders and hoists, engines, and also the Jaeger placing plant, which is a complete mixing and placing plant combined, are fully and attractively illustrated and described in two catalogs just issued by the Jaeger Machine Company, 212 West Rich street, Co-

lumbus, Ohio. Pavers and grouting outfits are also shown in fine pictures. Several of the halftones represent various jobs upon which these machines are employed, together with the placing plant. This company has been building concrete mixers ever since machine-made concrete was introduced, and its mixers are of the most improved revolving tilting drum, single opening, self-cleaning type. They are used by thousands of contractors in all parts of the country. Full particulars concerning the various kinds and sizes of mixers are given.

Linwood Stone & Cement Co. to Raise Output

Increase of its production from 65,000 cubic yards to 400,000 yards annually to be insured by September 1, is announced by the Linwood Stone & Cement Company of Davenport, Iowa. The company is installing a large amount of new stone crushing machinery, cars and other equipment and has been working on the development of its plant for several months.

The company now owns 274 acres of land at Linwood, Iowa. Chief Engineer N. P. Patnoe, who has built 28 quarries, is in charge of the reconstruction work at Linwood. It is expected that 50 men will be regularly employed at the plant soon.

Machinery has been electrified, the company to secure power from the local public utilities.

Dynamite Used in Breaking Up Concrete Foundations

In removing an old engine bed or foundation with dynamite holes should be drilled vertically to a depth of at least three-quarters the thickness of the foundation. If there is machinery or other property nearby likely to be damaged, it is best to fire only one hole at a time. It is difficult to say definitely just how to space the holes, because the shape and dimension of the object may be very irregular, but it can be taken as a safe rule to use about one-third of a 1¼ by 8-in. cartridge of ammonia 40 per cent dynamite, per cubic yard of material to be broken. More can sometimes be used with safety but as a general rule, if the charge is thus proportioned, no material will fly and yet it will be crumbled and cracked up so that it can readily be removed by hand labor.

An engine foundation 12 feet long, 4 feet deep, about 3½ feet wide, was successfully broken up by drilling three vertical holes, each 3 feet deep, along the center line, using one-third cartridge of 40 per cent dynamite 1¼ by 8 inches per hole. One hole was shot at a time.

In another instance, dynamite was successfully employed in breaking up a brick and cement foundation for heavy machinery. The base was a solid mass, 8 to 10 feet deep. The method used was as follows: Eight holes, 5 feet deep, were drilled vertically into the block. Small charges of dynamite were loaded into the holes, and well tamped in. Electric blasting caps were inserted in all eight charges, and by means of the wires connected up in series on the surface so as to get the cumulative effect of a combination shot.

As there was a large skylight less than 30 feet from the base, besides machinery nearby in the room, it was necessary to cover the bore holes first with burlap bags and afterwards with some heavy pieces of timber to prevent flying pieces of masonry from causing damage. When all was ready the charges were connected up to a blasting machine and fired. The result was that the block of masonry was shattered so that the various pieces could be handled and carried away by laborers. The entire job was done in 2 hours.

World's Largest Dry Dock Completed at Portsmouth Navy-Yard at Cost of \$4,000,000

The largest ships in the world can easily be accommodated in the immense dry dock recently opened at the Navy-yard, Portsmouth, Va., and it is not likely that ships larger than the capacity of the dock will be constructed by any nation for years to come, if ever.

The great basin of this largest and most modern dry dock on either the Atlantic or the Pacific coasts is 1022 feet in length. The width of the coping lines is 144 feet, and the width of the floor bottom is 112 feet.

There is a draft of 40 feet of water at mean high tide over the keel blocks and 43 feet over the sill. A floating caisson 132 feet long by 26-foot beam closes the entrance to the basin, which is known at the Portsmouth Navy-yard as dry dock No. 4.

The dock cost the United States Government \$4,000,000. It was constructed in less than two years at a record-breaking pace by the George Leary Construc-

tion Co. of New York city, and it was Mrs. George Leary who pushed a button which released the sluice gates and permitted the first inrush of water.

So vast is the great basin it required nearly a week for it to fill sufficiently to permit the entrance of the transport Agamemnon, formerly the German transatlantic liner Kaiser Wilhelm II, which has the honor of being the first ship to enter the new dry dock for repairs.

The Agamemnon is 706 feet and 6 inches in length by 72 feet beam, yet there was room for two more ships of average size in the dock after she had entered, and the new dock will accommodate a vessel 1000 feet in length, or approximately 25 vessels of average size.



Government's New Drydock, Recently Completed at Navy Yard, Portsmouth, Va.

The massive caisson withstanding the tremendous pressure of the Atlantic Ocean is but a natural detail of the picture made by the great dock, the size of

one of these three 54-inch centrifugal pumps has the power to pump the enormous quantity of 112,000 gallons of water into the basin every minute that they are in operation, this being accomplished against a head of 50 feet with 1500 horse-power, 2200-volt motors being required for each pump.

The mechanical equipment includes two 15-inch drainage pumps, sump and oil pumps, ventilating fans, heating system, mechanically-operated gatevalves, sewage ejectors and all necessary appliances and accessories, a great quantity of the mechanical equipment being stationed in vast subterranean chambers, far below the level of the dry dock.

When one set of sluicegates is opened the water will enter the dock through more than 400 openings in the floor and 20 large port holes in the side walls. By closing the flooding gates the water is pumped from

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the basin of the dock through the same 400 floor and 20 side-wall openings until the level of the water is nearly to the floor level, and then the large pumps are shut off and the remaining water is pumped out of the basin by the two 15-inch drainage pumps.

The cubical contents of the dock at mean high water is more than 44,000,000 gallons.

This makes dry dock No. 4 at the Portsmouth Navy-yard the most modern, if not the largest, dry dock in the world. The dry dock at Balboa is 1044 feet in length, or 22 feet longer than the Portsmouth dry dock, but it is not so modern in construction. Whether the German monster ship, the Leviathan, was built at a larger dock near the Kiel Canal than the Portsmouth dock is not known, but the fact remains that the Leviathan can be accommodated for repairs when needed at the new dry dock.

The United States Government took over the Leviathan during the war, and eventually, of course, the big ship will require repairs. The Leviathan is 890 feet in length, and is the largest commercial vessel in the world, yet if placed in the Portsmouth Navy-yard dry dock No. 4 there would be plenty of space on either side of it in addition to a clearance distance of 132 feet between the bow and the end of the dock.

The biggest warship building at present is the Hood, which Great Britain is constructing at an English shipyard. This gigantic dreadnaught will be 890 feet in length, considerably larger than any American dreadnaught, and yet it may be seen that this future largest dreadnaught in the world may also be accommodated in the new dry dock, with room to spare for several other smaller vessels.

Up to this time, the largest battleships in the United States Navy, when in need of repairs, have been compelled to make the long trip to Balboa in order to be put in shape for effective service, but now any battleship of any nation in the world, or any commercial ship, can find ample room in the Portsmouth Navy-yard dry dock No. 4, where a large force of skilled ship-repair men is already stationed for immediate activities, the first of which are exhibited in the work now being done on the Agamemnon.

Incidentally, it is very interesting to note that the new and great modern dry dock No. 4 is not far distant from the first dry dock constructed by this country on either the Atlantic or Pacific coast, and the old dry dock is still in use after nearly a century of service. Its construction was commenced in 1827, but it was not completed until 1833. Thus it required four years longer in those days to build the smaller dock than it has just required to build the greater. The first ship to enter the old dry dock was the wooden battleship Delaware, which was sent to the Portsmouth navy yard for repairs in 1833, soon after the first United States Government dry dock was completed.

Steel Forms for Silo's Water Tanks, Etc.

The Polk-Genung-Polk Co., Ft. Branch, Ind., has issued a folder describing the Polk System Junior adjustable machine for building concrete silos, grain tanks, water tanks, wood or coal houses, poultry houses, corn cribs, garages, laundry houses, milk houses, stock tanks, septic tanks, cisterns, well houses etc.

Mechanical Devices Handle Sand and Gravel Quickly and Efficiently

The increasing demands for sand and gravel have, within the past few years, led to the developing of much new machinery for the handling of such material.

One leading plant in this line is the Ohio River Sand and Gravel Co., of Louisville, Kentucky.

This company obtains its raw material from the Ohio River above Louisville, by means of dredges, and



These Concrete Storage Tanks Have a Capacity of 300 Cu. Yds. Each.

it is brought to their Riverside plant in barges.

These barges are unloaded by derricks which drop the material into cars that operate on an incline by means of wire rope. From these incline cars the ma-



Section of the Elevated Track in Storage Yard.

terial is either dumped into a large storage yard or into railroad cars for shipment to customers or to be transferred to an auxiliary distributing plant located on the west side of Louisville which is four or five miles from the Riverside plant, and so located as to cover a large territory.

At this plant are two large concrete storage tanks, each having a capacity of 300 yards. These plants are equipped with electrically operated machinery for both receiving incoming and loading outgoing material.

Sand and gravel can be shipped from this plant by both motor trucks for local distribution, and traction



Here are Shown the Derrick that Unloads Material from Barges, and a Section of the Wire Rope Incline that Carries the Sand and Gravel to the Storage Yard.

cars for interurban use. Cars and trucks are both loaded by gravity.

Before the use of auto trucks was adopted, deliveries were made by means of 2-cu-yd. wagons. It has been found that seven trucks, which have a capacity of $4\frac{1}{2}$ yds. of sand and $3\frac{1}{2}$ yds. of gravel, do the work of twenty wagons.

The road-building program that is scheduled for this year throughout the country will no doubt give renewed impetus to the sand and gravel business, and when the work gets under good headway, material will be wanted quickly and continuously.

An Auto-Crane of Varied Capacity

Auto-Crane Model 3 is admirably described and illustrated in Bulletin 1015, which has just been issued by the John F. Byers Machine Co., 204 Sycamore St., Ravenna, O. The wide variety and range of work which it is possible to do with this machine are amply presented, and every contractor, whether he undertakes building, sewer, road, street, hauling, ditching or excavating work, would be interested in having a copy of this excellent publication. The crane makes sewer trenches, handles heavy pipes, empties cars of stone or other material, grades streets, excavates for cellars and foundations, handles structural steel for the erection of buildings, drives piling, digs out sand, gravel or clay, as required; handles materials in shipyards, besides doing lots of other work for which it is excellently adapted.

Bonding New Cement Mortar and Concrete to Old Concrete

It frequently is necessary in construction and repair work to join fresh concrete to old or to concrete which has partially set. In order to obtain definite data on relative value of various methods of increasing the bond an extensive series of tests have been carried out in the Engineering Research Laboratory of the Bureau of Public Roads. This series included:

1. Tests on the bond strength in tension of a 1:2 mortar in the form of the standard tension briquette.

2. Tests on the bond strength in cross bending of a $1\frac{2}{3}:1\frac{1}{3}$ concrete in 4 by 4 by 14-in. prisms bonded to concrete slabs.

3. Tests on the bond strength in shear of a $1\frac{2}{3}:1\frac{1}{3}$ concrete in specimens in the form of 8-in. diameter cylindrical disks, 2 in. high.

4. Tests on the permeability or water-tightness of the joints formed by various bonding methods. The same specimens were used in this series as in the shear tests.

The conclusions drawn from the tests are summarized as follows by W. E. Rosengarten, U. S. Highway Engineer, Bureau of Public Roads, in a recent publication of the Bureau.

Bond Strength in Tension.—It may be safely stated that the ability of fresh mortar to adhere to older material decreases rapidly as the old sets up. Where the older material has set for 24 hours before adding the fresh, the bonding strength is but 44 per cent of that of monolithic construction. Further ageing of the old mortar causes a slight decrease in the bonding ability, which at 7 days is 39 per cent of the original, and at 28 days has reduced to 35.5 per cent.

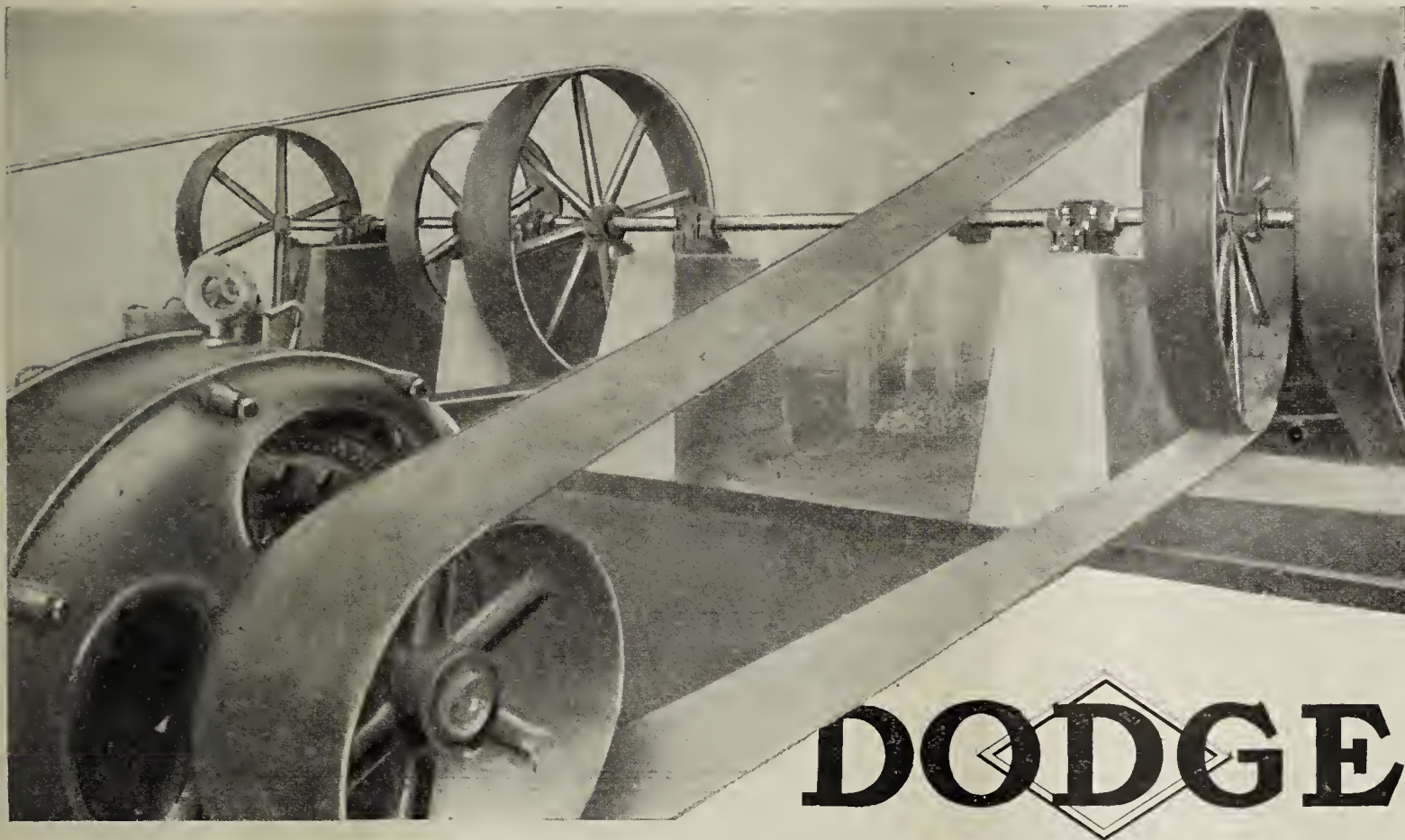
The bond of new concrete to old can, however, be increased by various methods, which include treatment of the old surface, the use of a bonding medium, and care in handling the new concrete.

The old surface can be treated to increase the bond either by roughing with a steel tool or by a treatment of dilute hydrochloric acid (1:10 concentrated acid and water). The acid acts on the cement particles, dissolving them and leaving the clean surfaces of the aggregate. The remaining salts should be washed off thoroughly. Roughing the surface increases the strength of bond 20 per cent, except in the case of the tests where the old concrete has aged 7 days, in which case there appears an unexplainable detriment to the bond due to the acid treatment. Combining both roughening and then treating with acid gives but a slightly greater bonding ability than either by itself.

The application of thin layer of cement butter as a bonding medium has a decided effect in increasing the adhesive strength. An additional 25 per cent in strength is developed by the addition of the cement butter layer. If the cement butter layer is allowed to stand one hour prior to adding the fresh mortar, an additional 3 per cent may be added to the strength. The use of a proprietary compound mixed in with the neat cement butter appears to be of little additional value.

The hard tamping of the new mortar against the old, thus forcing it into the pores, has a tendency to increase the strength of bond about 8 per cent.

The broken surface showed a greater bond than either the plain molded or natural surface, as might have been expected. The roughing of the two latter characters of surface had the effect of placing them on a par with the broken surfaces.



The right power transmission system for brick, clay, and cement plants.

The heavy and intermittent loads and high speeds necessary to the successful operation of brick, clay and cement plants are handled with perfect ease by Dodge built equipment.

Driving Griffin mills or operating elevating and conveying machinery through the medium of Dodge products assures utilization of the maximum of the power generated.

There are several fundamental reasons for the recognized success of Dodge equipment for this work.

First: Special and continuous effort in the design and development of machinery exactly suited to its needs.

Second: A wide margin of safety in shafting sizes, floor stands, pulleys,

clutches and all other equipment.

Third: Special facilities for building machinery to meet unusually severe operating conditions.

Fourth: A wide experience. While equipment of this class is usually regarded as "Special", the Dodge organization has built so much that it is regarded in the Dodge shops, as a regular part of the day's work.

If you contemplate building a new plant, adding to your plant or replacing worn or out of date equipment, get in touch with the nearest Dodge branch. Our experience is at your command without cost or obligation.

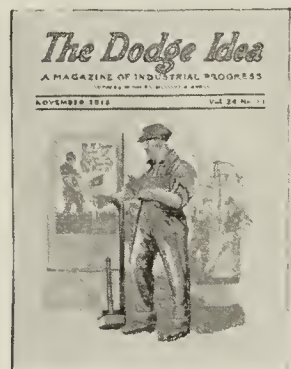
Dodge Sales & Engineering Company

Distributor of the products of the Dodge Manufacturing Company

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The ability to bond to the molded and natural surfaces appeared about equal. A tendency, however, is noted in the case of the surface molded against forms toward a decrease in the strength as the age of old concrete increases, while the natural surface appears to remain fairly constant after the concrete has aged 24 hours.

The effect on the bond of wetting the old mortar surface is hard to determine from the results of these tests. It is at present the usual practice to wet the old work thoroughly before attempting to bond fresh mortar to it. In about half the above tests this appears to have a detrimental effect, decreasing the bond strength about 10 per cent, while the other half shows it to have increased the bond strength 5 per cent.

The use of a bituminous bonding material is of little value.

The use of sodium silicate appears to have an effect on the bonding strength.

Bond Strength Cross-bonding.—The use of the hydrochloric acid wash on the concrete specimens appears to give a slightly greater bond than does the mechanical roughing of the surface. In the case of the mortar briquettes the opposite was the case.

The old concrete surface wetted develops a bond of only a little over one-fifth the strength of the monolithic concrete, roughing the surface or giving it a hydrochloric acid treatment increases the strength one-sixth and the application of a cement butter adds an additional one-fifth.

The results of this series of tests show the wetting of the concrete to be beneficial. The suggested theory that the cement particles are drawn into the old dry concrete by capillary action, thus increasing the bond, does not appear to be borne out by the tests.

The ability of the fresh concrete to adhere to the old decreased rapidly during the early stages of setting of the old concrete, from 100 per cent to about 30 per cent in the first 24 hours. After the old concrete has taken its final set the decrease with the age is very slight.

In general, it appears that (a) by careful treatment new concrete can be made to adhere to old with a strength equal to 60 per cent of monolithic concrete. If a greater bond than this is desired it will be necessary to resort to dowels drilled into the old concrete.

(b) If no special treatment is given the old concrete other than cleaning off foreign substances before adding the fresh concrete, a bond of but 20 per cent of the monolithic concrete is developed.

(c) The surface of the old concrete can be roughened or treated with a 1:10 dilute solution of hydrochloric acid which will increase the bond by 20 per cent of the strength of the monolithic concrete.

(d) A bonding medium of a thin layer of neat cement butter spread over the surface of the old concrete will increase the bond 20 per cent of the strength of the monolithic.

(e) Tamping the fresh concrete hard against the old concrete, forcing the cement into the pores, increases the bond 5 per cent of the strength of the monolithic concrete.

It must be remembered that the above conclusions refer to a rich concrete—namely, 1:2/3:1—1/3, and that for leaner mixes the percentages very likely would be increased.

Shearing Strength.—The shearing strength of a joint is greatly increased by a treatment of the sur-

face of the old concrete, and although it may slightly increase the cost of the work, the added effect would certainly seem desirable.

Permeability.—The results of this series show that there is no danger of leakage at a joint made in concrete of a mixture as rich as 1:2/3:1—1/3, under pressures up to 40 lb. per square inch; when the surface of the old concrete has been treated.

Wagon Loader Does It All in Sand Pit

For downright simplicity, efficiency and economy in sand pit operation the plant of the J. L. Lorscheider Co., Chicago, at Rose Lawn, Ind., about 60 miles south of Chicago, takes the bouquet.

The only equipment used is a wagon loader run by gasoline motor, a couple of wheelbarrows and a shovel or two and with this simple equipment five to seven cars of sand can be loaded in a day, with a very small amount of manual labor. Two men and a boy can easily load eight cars per day. The difficulty in getting open top cars is no sticker for this plant, for the spout is put through the door of a box car, the sand flows into wheelbarrows and is wheeled to the ends until they are filled and then the center is filled and there you are. Open top cars are, of course, loaded without the use of wheelbarrows.

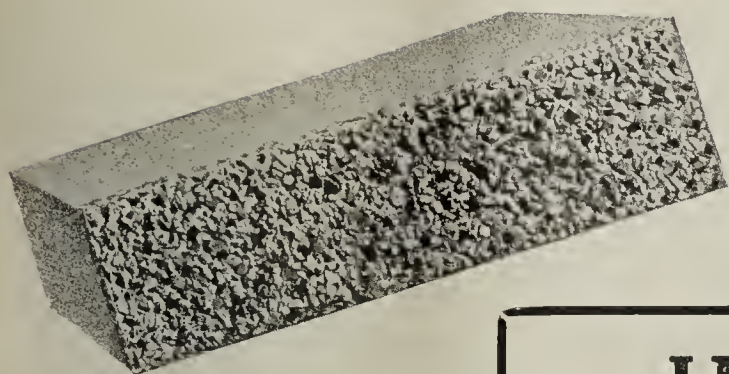
The character of the bank from which the sand is taken is largely responsible for the simplicity of operation. The sand is absolutely clean, free from dirt or stone and requires no screening or washing. All that is necessary is to get it from the bank to the car in the quickest and cheapest way and the wagon loader solves the problem perfectly.



Loading Gravel in Box Cars.

The bank is located beside the right-of-way of the Monon railroad about a half mile from the village. A sidetrack runs close up, with just room for the loader between the car and the bank. The track is so close to the bank that a five-foot extension spout is long enough to reach from the discharge pipe of the loader to the car. The loader is placed on a temporary plank platform so that it will not sink into the soft sand. A workman pushes the sand down from the bank to the buckets which scoop it up and raise it to the discharge spout.

When a cut has been made the entire length of the bank the side track is moved over and the operation is repeated. That's all there is to it. The loader will, when operating under favorable conditions, handle an average of 75 yards of sand an hour.



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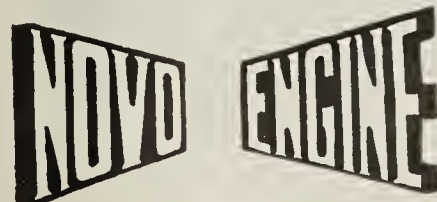
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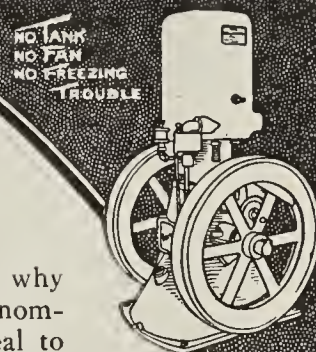
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Hollow Concrete Poles Made by Centrifugal Process

Concrete has the following advantages as pole material: Permanence, strength and availability. A novel process of concrete pole manufacture which retains the above advantages has been perfected recently. By this method hollow reinforced concrete poles are produced that compare favorably with wooden poles both as to weight and first cost.

The poles are made by a centrifugal process. In this process, the first step is to build up the reinforcing cage, similar to that used in a concrete pile. The longitudinal rods are securely wrapped with hooping wire that is tied at its intersections with the rods. The cage is then placed inside a mold, which, after being securely bolted up, is filled with the required amount of concrete. The mold is then clamped in a machine that revolves it at a high speed.

The centrifugal force resulting from this rotation, causes the concrete to be uniformly distributed, and densely compacted. The surplus water contained in the wet concrete is forced to the center, and when the mold is withdrawn from the machine at the close of the

operation, it runs out of the end in a clear stream. In a few minutes of rotation, the concrete is sufficiently compressed so that there remains no danger of collapse. It is so hard that a thumb nail makes but little impression upon it.

The process, because of the fact that absolute control over the concrete can be exercised, lends itself to the production of ornamental effects. This fact has created a demand for such poles in the street lighting field, and there are now in operation at Chicago, Milwaukee and several smaller cities, street-lighting systems in which these poles are installed. For ornamental effects, special aggregates are used. These are given surface treatments which produces a concrete indistinguishable from natural stone.



30 ft. Lighting Standard Used by Milwaukee.

The accompanying illustration shows a 30-ft. double bracket lighting standard used in the city of Milwaukee, Wis. It has smooth natural concrete finish. The pole was manufactured and hauled 1½ miles from the factory and put in place in 96 hours.

An elaborate series of tests has been made on poles constructed by this process that confirm the assumptions made in their design. The test demonstrated an unexpected resilience of the poles, 25 and 30-foot poles deflecting 10 to 12-inch, without failure, sustaining loads that have a ratio varying from two to three when compared with the designed loads. The result of a test made on a 25-ft. pole, 7-inch in diameter at the top, 13¼-inch at the butt, and weighing 1,700 pounds, is given in the following table:

Load, lb.	Deflection at top, in.	Load, lb.	Deflection at top, in.
100	0	3,000	6 3-16
525	3/8	3,580	7 7-16
1,000	1	4,075	9 1/4
1,500	2 3-32	4,575	10 5/8
2,000	3 5/8	5,425	Broke
2,500	4 5/8		

The standard poles made by this process range from 20 ft. to 40 ft. in length, and are divided into five classes—1,000, 1,500, 2,000, 3,000 and 4,000—the numbers indicating the pull in points which the poles are guaranteed to withstand. The diameter at the top of the pole ranges from 8¼ in. for the Class 4,000 to 5¾ in. for Class 1,000. The diameter at the butt varies



Testing Hollow Reinforced Concrete Pole.

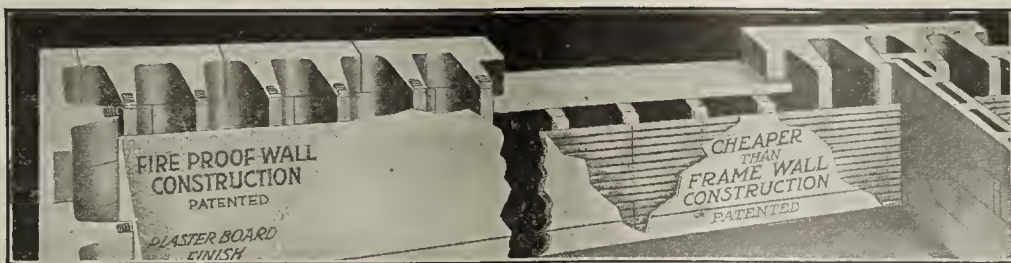
from 10¾ in. for a 20-ft. Class 1,000 pole to 23¼ in. for a 60-ft. Class 4,000 pole. The approximate weight of the latter is 12,400 lbs., while the approximate weight of the 20-ft. pole is 865 lbs.

The hollow concrete pole was developed by the Universal Concrete Products Company, Chicago. It is being marketed by the Massey Concrete Products Corporation, Peoples Gas. Bldg., Chicago.—[Engineering-Contracting.]

Steel Forms for Silo's Water Tanks, Etc.

The Polk-Genung-Polk Co., Ft. Branch, Ind., has put on the market a new form that promises to effect a substantial saving in the cost of concrete silos. The outstanding feature of this form is that it builds a 4-in. instead of a 6-in. wall, which has been customary heretofore. Experience has shown that a 4-in. wall properly made is amply strong for small and medium sized silos, and the fact that it saves one-third on the materials required is expected to reduce the cost of construction considerably. The Polk company claims that with this form a contractor can compete dollar-for-dollar with any silo on the market. Another good feature is that diameters of 10, 12 and 14 ft. can be built with the same outfit. The form is made in sections 24 in. high and 25 1/16 in. wide. This width is used because it makes possible setting up both inner and outer rings for the 3 diameters without using fractional sections. For a 4-in. wall the outer ring requires one section more than the inner ring. It is therefore evident that if it is desired to build a 6 or 8-in. wall, as in a water tank of considerable depth, this can be done by placing an extra half or whole section in the outer ring. Either 2 or 3 sets may be used, which will build 4 or 6 ft. per day, respectively. In addition to silos a large number of other structures can be erected to good advantage with circular forms. Among these are stock tanks, water supply tanks, cisterns, grain bins, milk houses, root cellars, and garages. Every farm requires considerable of such work and it may profitably be combined with silo building.

SYNSTONE PRODUCTS

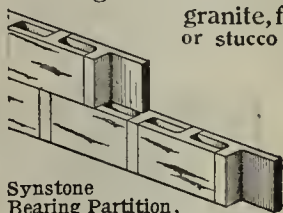


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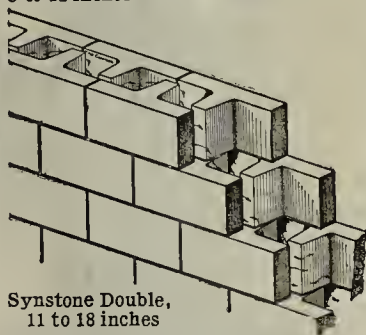
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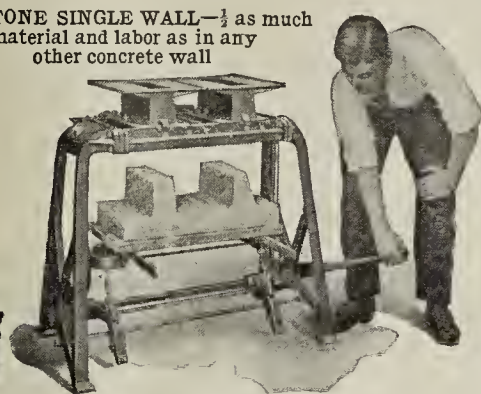


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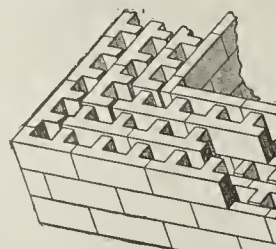
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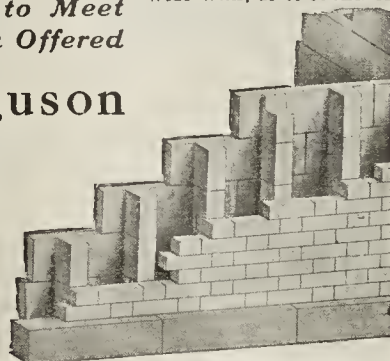
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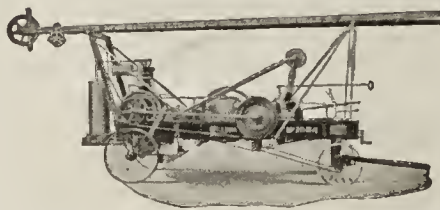
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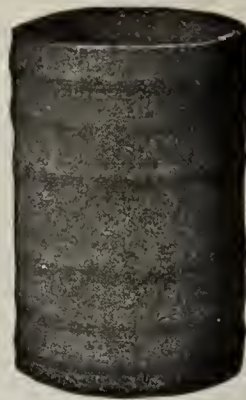
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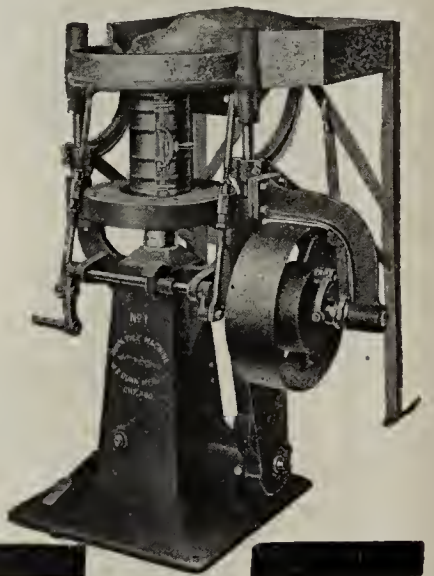
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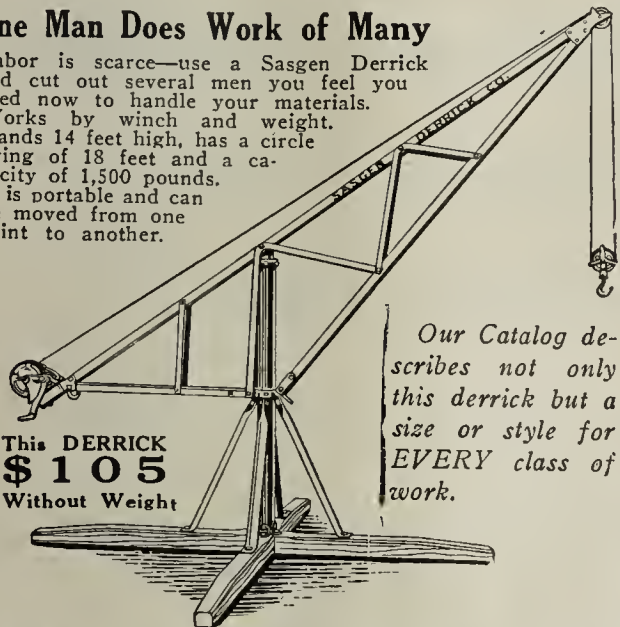
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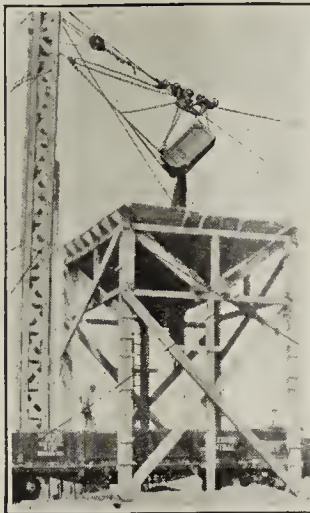


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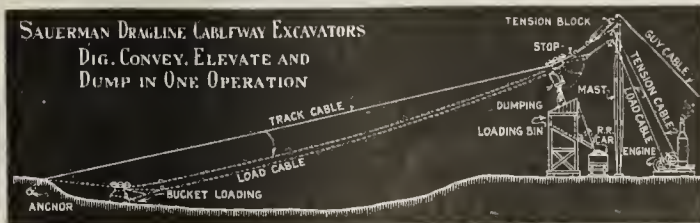
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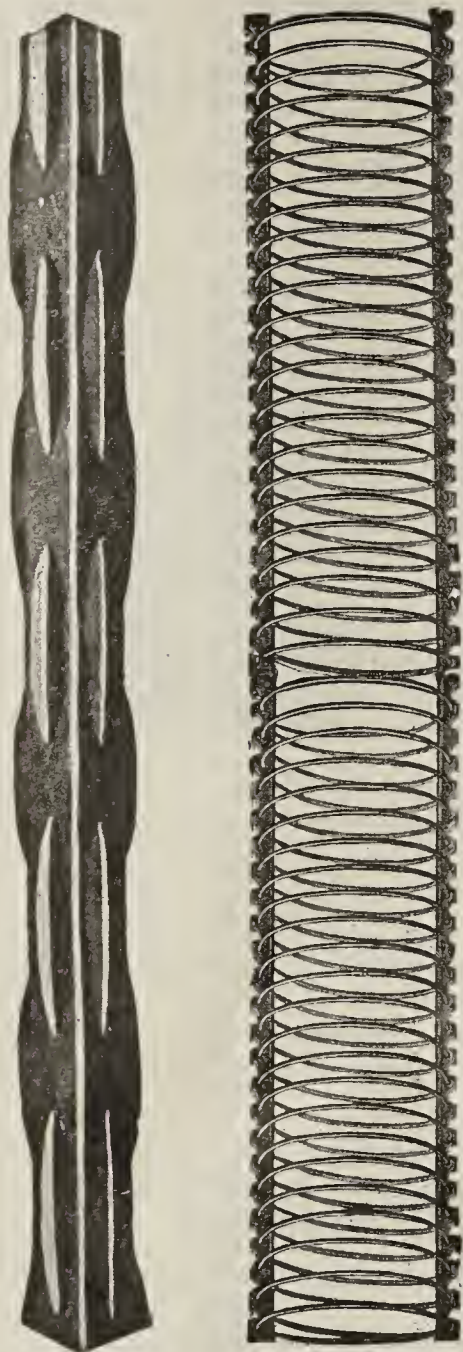
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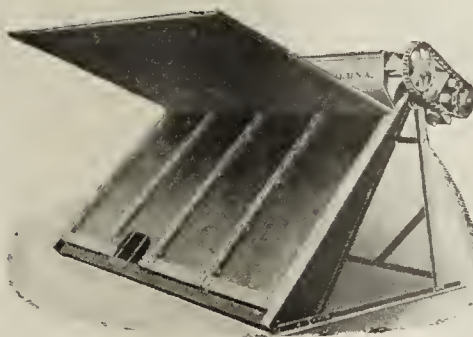
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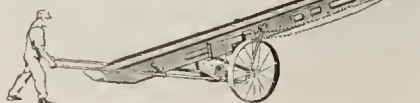
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**THE
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CONVEYOR**



Saves 6 to 10 Men
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COAL, COKE, ASHES
SAND, GRAVEL etc.

OVER 1000 USERS

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PORTABLE MACHINERY CO.
PASSAIC, N. J.

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210 to 214 South Fourth Street, ST. LOUIS, MO.

We make a specialty of
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Chemical Apparatus, Chemicals and Reagents

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Schumann's, LeChatelier's and Jackson's
Specific Gravity Apparatus, Etc.

Pyrometers, Calorimeters

High Grade Goods Only

Satisfaction Guaranteed



Austin Cube Mixers Insure More Mixing In a Minute

A mix-a-minute specification does not make all mixers equal.

Austin Cubes give 25 to 40% more mixing action in a minute because they mix by kneading.

Additional mixing in a minute makes **Cube Concrete extra-workable**—it is more easily spread and tamped and finished.

On much work where pasty concrete is specified, the 25 to 40% additional mixing given a minute batch by an Austin Cube increases materially the ease of placing and compacting and smoothing the concrete slab.

When time of mix is not specified, the intensive action of the Austin Cube produces a mixture of required perfection in two-thirds to three-quarters of the time required by machines which do not mix by scientific action—by incorporation under pressure.

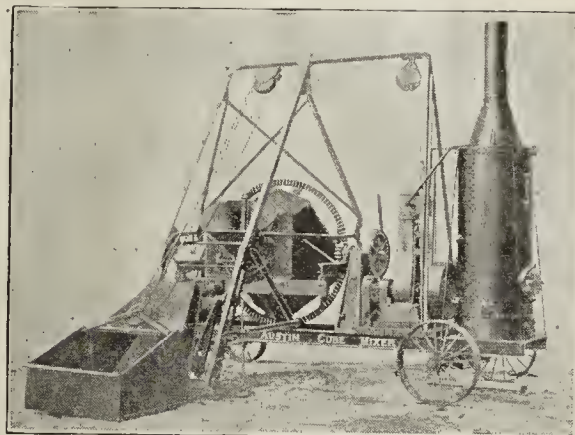
Interlining Plates Make Cubes Everlasting.

Send for your copy of book which describes the complete line of Austin mixing machinery with specifications, drawings, production records, data on length of life, repair costs, etc.

Ask for Catalog No. 21.

For those who prefer the "blade" type drum the **Austin Drum Mixer** is the logical choice. Wide loader and opening into drum permit fast charging without clogging.

Design of mixing blades such that the mix is carried over on discharging chute very wet, allowing rapid discharge, either entire batch or part. Capacity 60 to 80 cu. yds. per day. Nowhere has it found its equal in round drum mixers.



If a mixer of this type is desired ask for Catalog 21-D.

THE F. C. AUSTIN LINE

Trenching machines
Backfillers
Farm Tile Trenchers
Drag Line Excavators
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Levee Builders
Ditching Machines with Bank
Sloping Attachments
Drainage Excavators
Multipedal Tractors
Wheel Tractors

Wagon Loaders
Cube Concrete Mixers
Cube Pavers
Cube Hot Mixers
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Motor Flushers and Sprinklers
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F. C. Austin Company, Inc.

Main Office Railway Exchange, Chicago

New York Office, 30 Church St.

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SPECIAL FOR LEASE OR SALE

- 1—15-20-ton 8-wheel Brownhoist Locomotive Crane, 50-ft. Radius Boom.
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Several Clam Shell Buckets, Various Sizes

- 2—No. "O" Thew Traction Steam Shovel, $\frac{3}{4}$ -cu. yd. Dipper.
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ALSO CONSIDERABLE OTHER EQUIPMENT.

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Locomotive Cranes, Cars, Steam Shovels, Locomotives, Etc.
Continental and Commercial Bank Building, Chicago
Shops and Storage Yards at Chicago. All Equipment Owned by Us.
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MACHINERY BARGAINS

No. 12K Gates Crusher, manganese fitted, nickel steel shaft, \$5,750.00.

1—2,500-ton Crushing Plant, manganese fitted, with Corliss engine drive.

2—1,500 cu. ft. Air Compressor (steam) Duplex.

20 Crushers, No. 2 to 12.

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2—300HP., 180-lb. water-tube Boilers, \$9.00 HP.

1—400HP., 180-lb. H.R.T.-W.T. Boiler, stoker, \$9.00 H.P.

2—350HP., 160-lb. H.R.T.-W.T. Boilers, \$9.00 HP.

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1—50HP. locomotive type Boiler, 150-lb., stack.

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- No. 3 Gates Gyratory for fine sizes
- No. 4 Champion jaw opening 9"x15"
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WICKES MACHINERY CO.,
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- Brand new No. 3 Exeter, capacity 21' mixed concrete mounted on trucks with steam engine
- 1000 other machinery bargains

WICKES MACHINERY CO.,
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For immediate Delivery—Overhauled and Guaranteed—Largest Stock in America to Choose From.
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1—15 —Fairbanks-Morse ...	1200
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Capital and Surplus, \$500,000.00

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Diesel Oil and Gas Engines, Generators, Motors

First-class Condition
Prompt Delivery

AMERICAN DIESEL OIL ENGINES:

- 1—120 BHP. Vert. 3 cyl. belted.
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1—150 BHP. Sgl. Cyl. 2 cyc. semi-Diesel, d. c. to 125 KVA. 3 ph. 60 cy. 2200 V. Genr.

1—100 BHP. Vert. 2 cyl. Oil Engine, belted.

1—150 HP. 3 cyl. Vert. Gas Engine, d. c. to 100 Kw. 220 V. D. C. Genr.

1—100 HP. 3 cyl. Vert. Gas Engine, d. c. to 65 Kw. 125-250 V. 3-wire Genr.

1—35 HP. Horiz. 2 cyl. Oil Eng.

1—85 KVA. 3 ph. 60 cy. 2300 V. Genr. Bltd.

1—75 KVA. 3 ph. 60 cy. 230 V. Eng. type Genr.

A. McMILLAN
619 Monadnock Block
CHICAGO, ILL.

Specialists in Diesel
Oil Engineering

WANTED — SUPERINTENDENT
for Stone Crushing Plant. Address, giving age, experience, references, and salary expected. F. C. SHELDON, Granville, N. Y.

CHEMIST.

A highly competent and efficient chemist with ten years' experience as chief chemist and superintendent wishes to communicate with a company having such a position open. Address C. D., c/o Cement and Engineering News, 672 Transportation Bldg., Chicago.

HELP WANTED.

We have positions open for the following:

Three experienced Cement Plant Superintendents, \$3,600 to \$5,000 per year.

Two Cement Plant Foremen; also one assistant Superintendent, \$150 to \$225.

Two Cement Plant Chemists, \$125 to \$175 per month.

H. H. HARRISON & CO., Association Building, Chicago.

MR. QUARRY OWNER—HAVE YOU A QUARRY AND rock crushing plant that is fully equipped with up-to-date machinery, having transportation and plenty of rock resources and man power, yet you know that production is not satisfactory? Why not consider my proposition as expert efficiency man? I will on salary basis and bonus guarantee to increase production to maximum capacity. Address A. Anthony, 812 Fifth Ave., Oakland, Calif.

1600 BARREL CEMENT PLANT FOR SALE

1—Complete Portland Cement Plant, located in Middle West, ready to operate. Was run only a few months. A great bargain. For full particulars and prices, write—

THE J. G. TILLEY CO., Bristol, Va.

New and Relaying **RAILS**

all weights and cut to any length
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Completely Equipped Cement Plant

Stockertown, Pa.

CAPACITY OF 2,000 BARRELS PER DAY

A series of 1-story buildings, all directly connected, including boiler and engine room, drying and grinding rooms, kiln room, engine room, machine shop, baggage room, cooper shop and storage limestone bins, etc. **LARGE POWER PLANT. L. V. & N. E. R. R. SIDING. 69 acres. LARGE CEMENT QUARRY, DEEP FACE.** Heart of cement country. Excellent labor. **STOCKERTOWN, 5 MILES FROM EASTON, PA.**

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For Sale—Second-hand industrial cars and track. Twenty-five 1½-yard 24" cradle dump cars. Twelve 1-yard Lakewood V type dump cars. Ten thousand feet track. Eighteen switches.

For Sale—One brand new 1-yard Page Drag Line bucket, Chain hoist bale, heavy magneese steel cutting edge, carbon steel trunions and two-part magneese steel teeth.

Union Sulphur Co.

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TRUSCON Waterproofing Paste Concentrated

Truscon Waterproofing Paste Concentrated provides certainty of results and economy in costs. Certainty because it has proved itself. Used in many thousands of buildings and it has always given perfect results. Economy because it is the only concentrated waterproofing material on the market. It contains absolutely no fillers—every particle possessing maximum waterproofing value. This provides the lowest cost per cubic yard.

Learn about Truscon Waterproofing Paste Concentrated by receiving Structural Waterproofing. This handsomely illustrated volume, 8½x11 inches, will be sent free on request written on business stationery.

The Truscon Laboratories

Manufacturers and Inventors of
Waterproofings, Dampproofings,
Technical Paints, Floor Hardeners

DETROIT

MICHIGAN

INVESTIGATION AND EXPERIENCE ARE PROVING THE RELIABILITY OF HYDRATED LIME

FOR WATER PROOFING AND TO FACILITATE POURING CONCRETE



In these 51 concrete storage tanks, recently erected in Cedar Rapids, Iowa, by the Quaker Oats Co., there are approximately 12,500 cubic yards of concrete—1-2-4 mix. The walls are perfect cylinders, with no lips or bulged surfaces.

Hydrated lime was used for waterproofing and also to facilitate pouring the concrete and lifting the forms, owing to its lubricating properties. In mixing, 25 pounds of hydrated lime was put into each batch, which made the percentage of lime to cement a little over 8% by weight. The mixers used were of such size that three bags of cement could be used in each batch.

Considerable credit is given by the Leonard Construction Co. of Chicago to the lime. The statement is made that the lime gave the exterior surface a white and uniform appearance, and that the surface needed no subsequent coating. There were no joints where the concrete stuck to the forms and "lifted," as it does in many cases where the concrete is not of uniform mixture.

Write any of the following competing manufacturers of Hydrated Lime for complete information about Hydrated Lime in Concrete

Marblehead Lime Co., Chicago—Kansas City	Ste Genevieve Lime Co., St. Louis, Mo.	Kelley Island Lime & Transport Co., Cleveland, Ohio	Woodville Lime Products Co., Toledo, Ohio
Port Byron Lime Assn., Port Byron, Ill.	Palmer Lime & Cement Co., 103 Park Ave., New York, N. Y.	National Lime & Stone Co., Carey, Ohio	Merion Lime & Stone Co., Norristown, Pa.
Lee Lime Co., Lee, Mass.	Rockland & Rockport Lime Co., New York—Rockland, Maine—Boston	Ohio Hydrate & Supply Co., Woodville, Ohio	American Lime & Stone Co., Tyrone, Pa.
White Marble Lime Co., Manistique, Mich.	O. C. Barber Allied Industries Co., Canton, Ohio	John D. Owens & Son Co., Owens, Ohio.	Vermarco Lime Co., West Rutland, Vt.
Glencoe Lime & Cement Co., St. Louis, Mo.	Hunkins-Willis Lime & Cement Co., St. Louis, Mo.	Riverton Lime Co., Riverton, Va.	Union Lime Co., Milwaukee, Wis.

Jeffrey Type "B" Swing Hammer Pulverizer

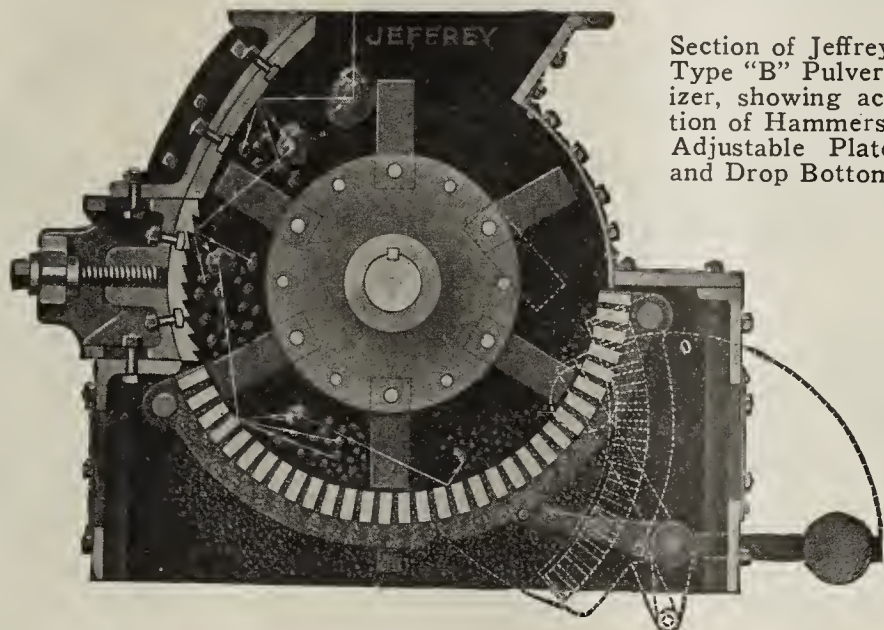
*For Reducing Limestone for Tube Mill Feed—
Shale—Clay—Marl—Gypsum, Etc.*

For Breakdown

Raw Limestone 10
to 200 tons per hour,
1/2 inch and under.

For Concrete Work

Reduces the stone to
a blended product
for contractor.



Section of Jeffrey
Type "B" Pulver-
izer, showing ac-
tion of Hammers,
Adjustable Plate
and Drop Bottom

Some Distinctive Features

Top Feed—Makes a fine product—reduces wear and power consumption.

Adjustable Breaker Plate—Insures a uniform product—saves power.

Pivoted Drop Bottom—Takes care of tramp iron and like substances.

Ring Oiling Self-Aligning Bearings with Bronze Linings—Dependable for long, continuous service.

Heavy Shaft of High Carbon Steel—Insures smooth running and absence of vibration.

Hammers of Manganese Steel—The best material for resisting abrasion.

Screen Bars of Hardened High Carbon Steel—Wide openings between the bars prevent clogging the machine when pulverizing wet coal—allow small pieces of iron to pass through without dropping bottom or stopping machine.

Write for Pulverizer Catalog No. 147-M.

The Jeffrey Mfg. Co.,
914 North Fourth Street

Columbus, Ohio

New York
St. Louis

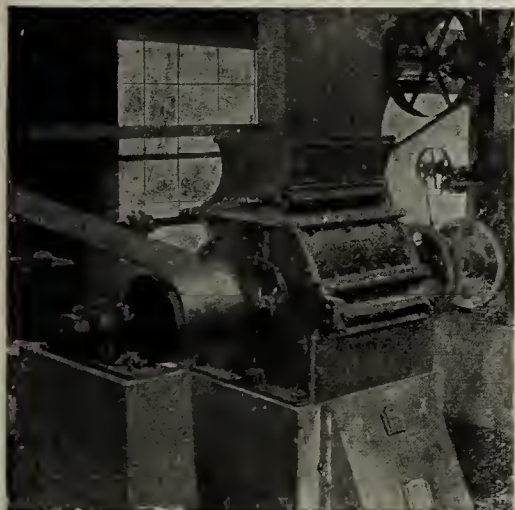
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Philadelphia
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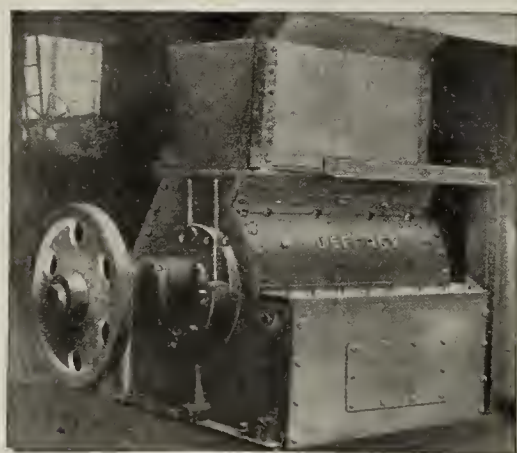
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Denver
Scranton

Seattle
Chicago
Dallas

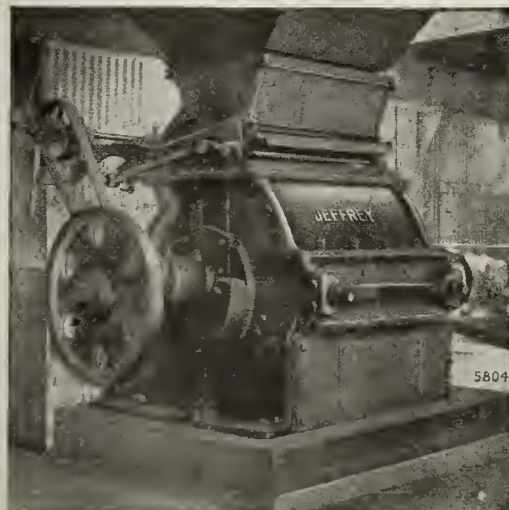
Montreal
Detroit



Type B Pulverizer reducing dry limestone for the tube mill feed



Type B Swing Hammer Pulverizer reducing limestone to 3/4-inch and under for manufacturing cement



Type B Pulverizer with Automatic Plate Feeder, reducing limestone

CEMENT AND ENGINEERING NEWS

with which Gravel & Stone Magazine is incorporated

22 Quincy Street, Chicago.

(PUBLISHED MONTHLY)

William Seafert, *Publisher and Editor*

J. F. Waldron, *Advertising Manager*

R. M. McCully, *Business Manager*

Telephone, Harrison 5397

Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, \$1.00 per year; all
other countries, \$1.50 per year.
Single Copies 20c.

DISCONTINUANCES—The greater part of our subscribers prefer NOT to have their subscriptions interrupted, in case they fail to remit promptly for renewal. It is therefore assumed, unless notification is given to the contrary, that the subscriber wishes to continue taking our paper. Therefore CEMENT & ENGINEERING NEWS will be sent until we are notified to discontinue—Such notice should be sent when the subscription expires.

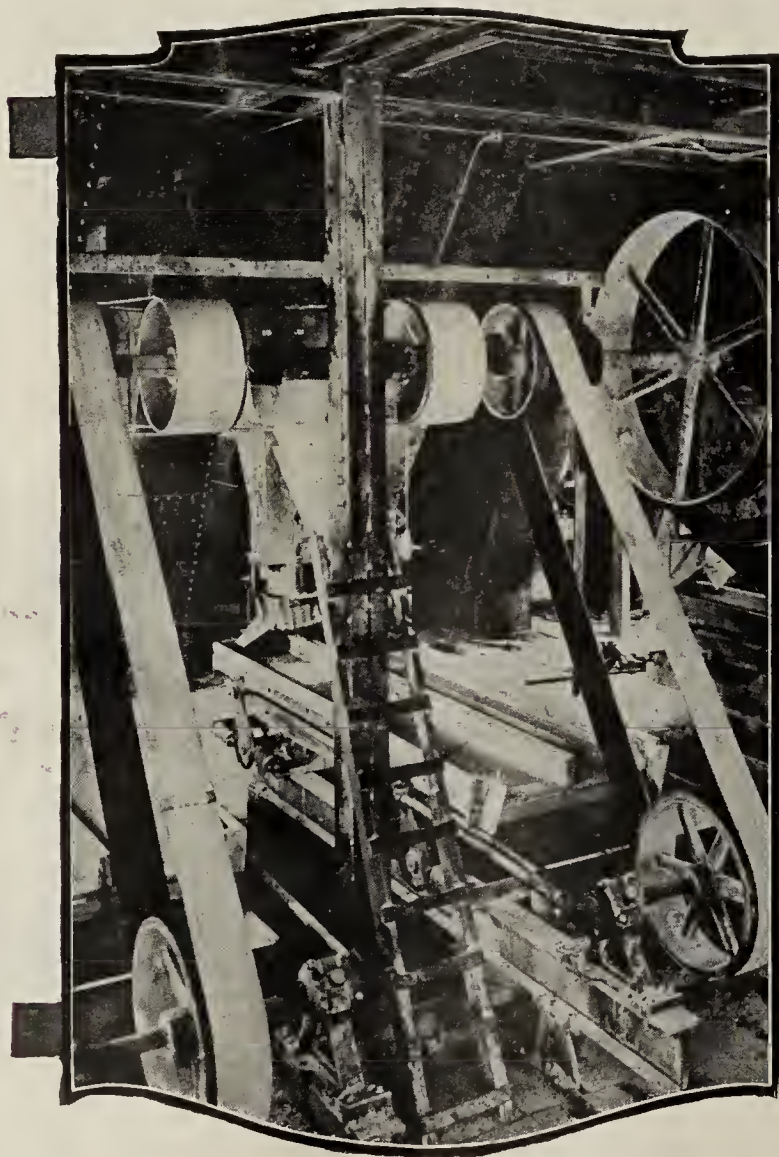
Advertising copy or changes in ads. must be in this office by the 25th of each month, as hereafter our magazine will appear on the 5th of the following month

Advertising Rates Sent on Application

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TRADE **SAWYER** MARK
Registered

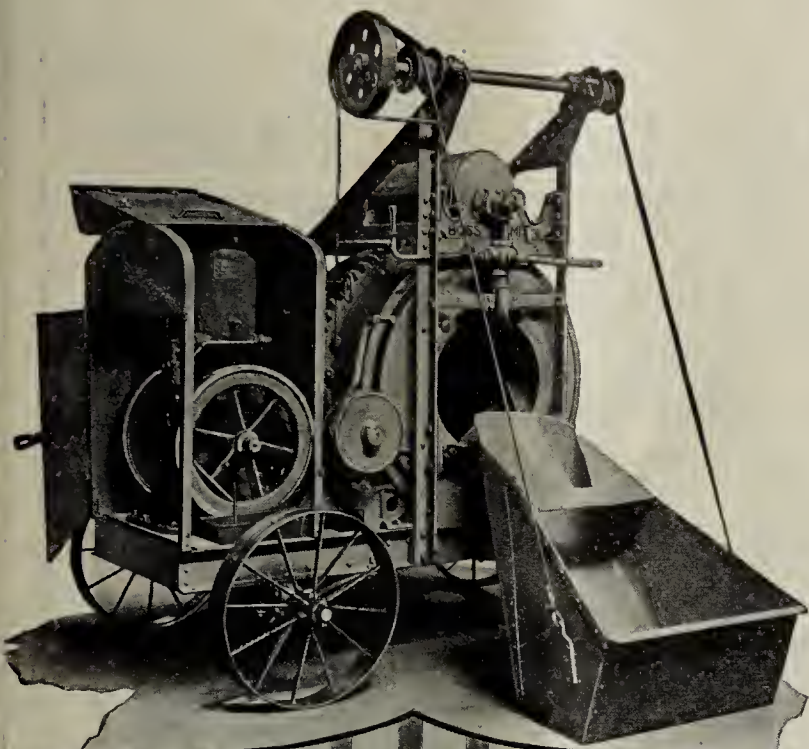
Stitched Canvas Belting

For hard, gruelling service transmitting power—on both main and counter drives—as well as on elevator and conveyor work, Sawyer Stitched Canvas Belting cannot be excelled.

Specify Sawyer—it is backed by the world's largest manufacturer of canvas belts and rubber goods.

United States Rubber Company





FASTER DISCHARGING

ALSO STRONGER AND MORE UNIFORM
CONCRETE THROUGH OUR PATENTED
HIGH SPEED "RE"-MIXING ACTION

BATCH A MINUTE IF
YOU WANT IT

BOSS MIXERS

(MIX MORTAR AS WELL AS CONCRETE)

Hyatt Roller Bearings and Steel
Roller Pinion Drive Used in Boss
"Built of Steel" Mixers and Hoists

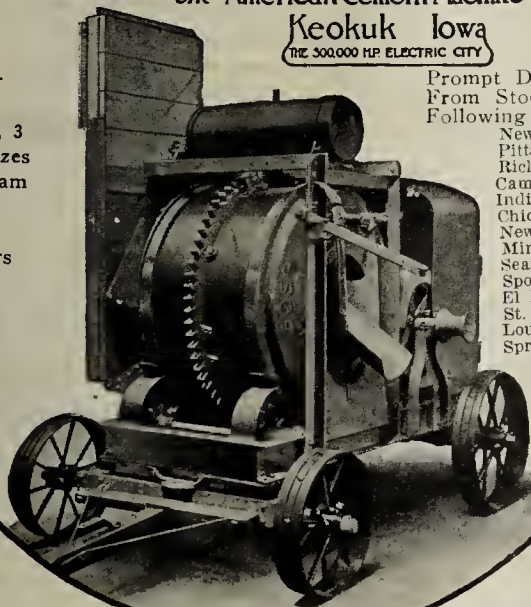
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The American Cement Machine Co. Inc.

Keokuk Iowa
THE 300,000 HP ELECTRIC CITY

Prompt Deliveries
From Stocks in the
Following Cities:
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Richmond
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½, 1, 2, 3
Bag Sizes
Gas-Steam
Electric
Low
Chargers



Leschen Wire Rope

There are many years of manu-
facturing experience back of
every Leschen Wire Rope, which
insure a product that is uniform
and durable.

We make high grade Wire Rope
for all purposes. If you will
tell us how you use wire rope
we shall be glad to suggest the
correct rope for the work.



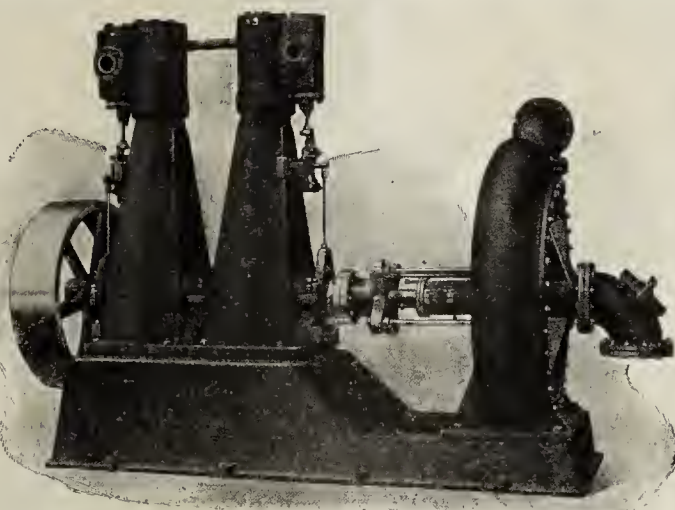
Illustrated catalog
gladly sent upon
request.

Established 1857

A. Leschen & Sons
Rope Co.

ST. LOUIS, U. S. A.

New York Chicago Denver
San Francisco



FOR handling your sand and gravel with the
lowest first cost as well as the minimum operat-
ing cost use

Erie Sand-Gravel Pumps

Small sizes as well as largest ones are designed
to give maximum output and greatest wear for a
given weight.

Catalog C30 gives complete information
on all styles and sizes of Erie Sand-Gravel
Pumps. Write for a copy now.

Erie Pump & Engine Works
MEDINA, N. Y.



LITTLE DAILY LEAKS OF POWER BOOSTS YOUR COAL BILL

The High Cost of Power Is Reduced to a Minimum By the Use of a

Plamondon Disc Type Friction Clutch

The power of this clutch is unusual. The double toggles on this clutch develop such tremendous pressure that even on the largest clutches only a hand lever is needed to engage or disengage the clutch. The geared devices usually needed to operate large clutches are unnecessary.

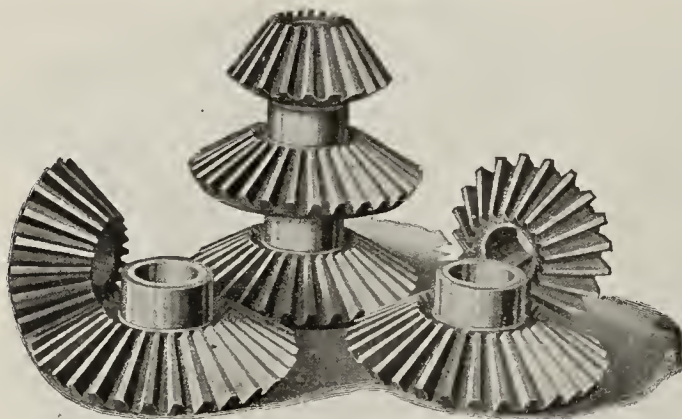
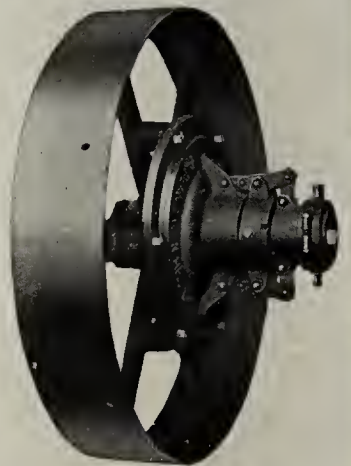
This is only one of the practical advantages the cement mills find in this clutch. Write for our new catalog No. 59 and learn the rest of them.

WE ALSO MANUFACTURE GEARS

A. Plamondon Mfg. Co.

12-24 N. Clinton St.

CHICAGO, ILL.



Make Your Gear Service a Certainty

Ganschow Bevel Cut Gears—like Ganschow Gears of every kind—are cut with an accuracy and precision which makes smooth, easy, effective working a certainty. They minimize wear and tear and insure long life to the parts. From twenty to forty per cent less power is required to operate

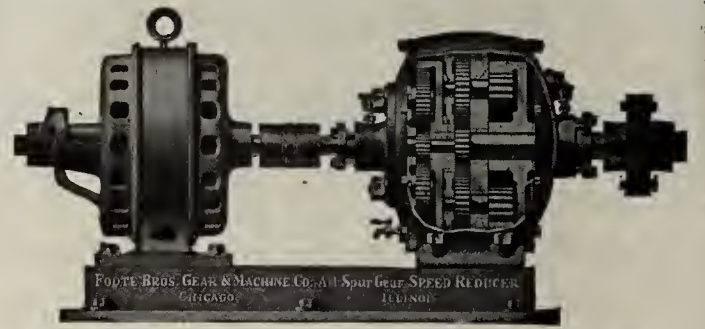
Ganschow Cut Gears

as compared with cast gears, because of evenly-thick and evenly-spaced teeth, and because they are uniformly smooth. Throughout the whole machine the jar and strain are greatly reduced; and this means gear-efficiency from every standpoint.

As specialists in gear work, our splendid facilities enable us to take care of any requirement from the smallest gear up to 12 ft. in diameter—and do it QUICK. Every gear strictly according to specifications and free from defects.

How about YOUR gear requirements?

Wm. Ganschow Company, Chicago, Ill.
1003 W. Washington Street



SPUR GEAR SPEED REDUCERS

Note they are dust proof, compact, made in any horse power or reduction. Just what is needed on conveyors, elevators and reduction of speed anywhere. We manufacture cut gears. Send for catalogue.

FOOTE BROS. GEAR & M. CO.

203 North Curtis St., Chicago

FROGS SWITCHES CROSSINGS

Portable and Industrial Track, Tie Plates, Switch Stands, Rail Braces, etc. Can make prompt shipments.

WRITE FOR CATALOG D

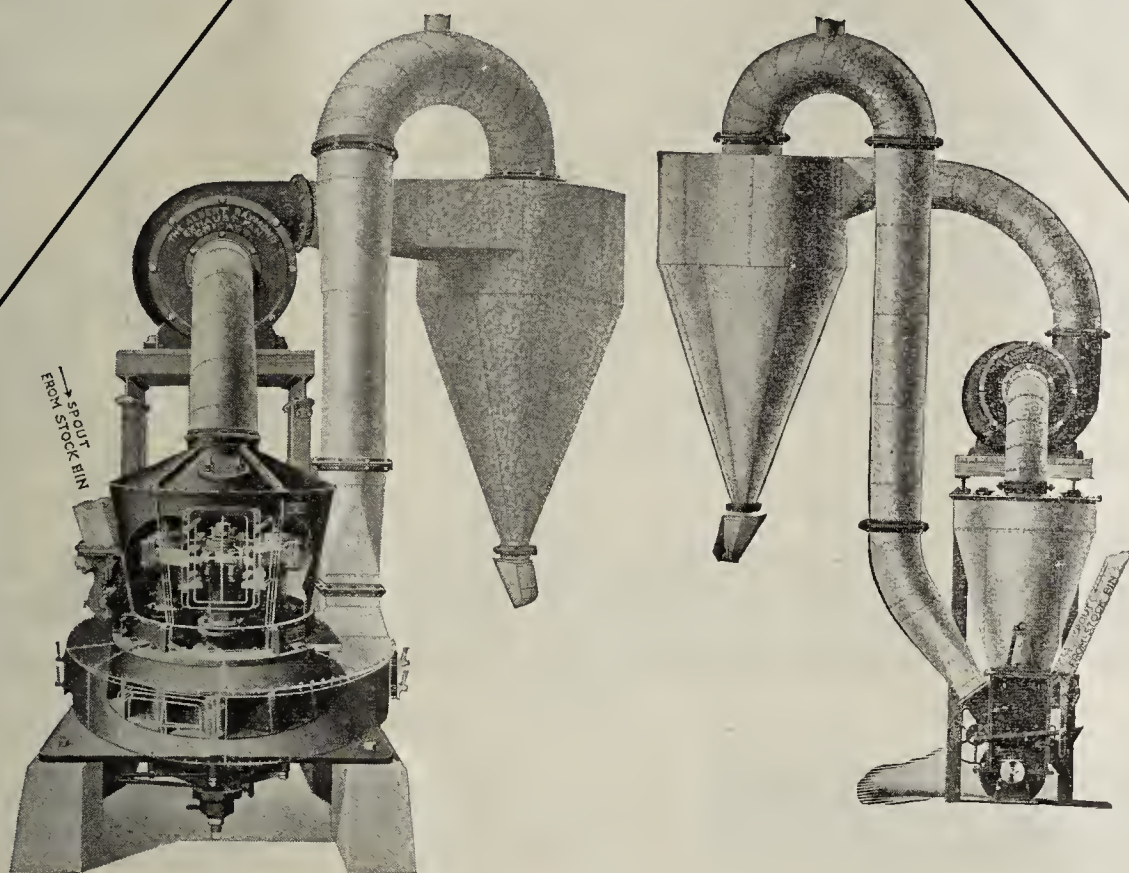
— Established 1906 —

THE CINCINNATI FROG & SWITCH CO.
Cincinnati, Ohio

RAYMOND

PULVERIZING AIR SEPARATING SYSTEM

THE OHIO HYDRATE
& SUPPLY COMPANY'S
PLANT ILLUSTRATED
AND DESCRIBED ON
PAGES 33 AND 34, THIS
ISSUE, IS EQUIPPED
WITH
RAYMOND MILLS



Raymond Roller Mills equipped with Air Separation are producing large economies in the grinding of coal, gypsum, limestone, phosphate rock and many similar products.

They handle these materials in one operation automatically and without dust. The material is fed in with an automatic feed, ground to a powder, air separated to produce uniformity and delivered dustlessly to a conveniently located storage bin.

If you have a fine grinding proposition and are looking for the best machinery with lowest ultimate cost, ask us for a recommendation and quotation.

For Hydrated Lime the Raymond Automatic Pulverizers have proven themselves to be the very best and most economical machine on the market. They are employed in over 90% of the hydrated lime plants of the country and have replaced every known type of equipment used for this purpose.

These pulverizers are complete units combining grinding, screening and elevating operations. They air separate the hydrate, cleaning out core, sand and unburned lime and elevate the finished product to storage bins.

Full information will gladly be sent.

**EVERY RAYMOND MILL IS COVERED BY AN ABSOLUTE
GUARANTEE BASED UPON PAST PERFORMANCES**

RAYMOND BROS. IMPACT PULVERIZER CO.
1301 North Branch St. Chicago, Ill.

Western Office: 202 Boston Bldg., Denver, Colo.

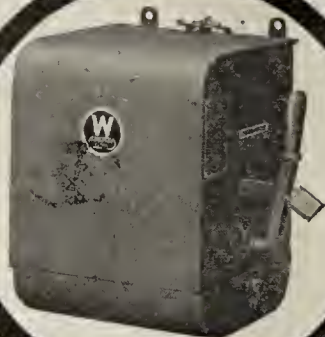
Type "A" Auto-Starter

For Cement Industry

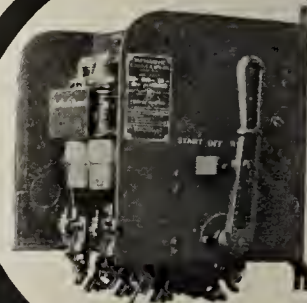
To supply an auto-starter which will meet the rigid requirements of present day service, the Westinghouse Company offers a new type A auto-starter, with the following important features:

1. It has an open-hearth steel case.
 2. It has a low-voltage relay, mounted inside the case.
 3. It has fuses or overload relay, mounted inside the case.
 4. It has a safety device that disconnects the motor when cover is removed.
 5. It has a safety device to lock starter in OFF position when repairs are being made to machinery.
 6. It has voltage-reducing transformers designed to permit changing from light to heavy duty starting.
 7. It has non-inflammable micarta base.
 8. It has contacts the same as used in steel mill automatic, and heavy main line locomotive controllers with a rolling and wiping action when opening or closing.
 9. It has contacts mounted in such a manner that they may be removed or replaced without disturbing the wiring or the mounting of the starter.
 10. It has special insulation in the voltage-reducing transformers.
 11. It can be installed with or without conduit.
 12. It requires minimum expense for installation.
- In the development of this auto-starter, no detail has been omitted to—
 Insure greater safety to the operator.
 Afford the best protection for expensive machinery.
 Reduce the expense of upkeep and installation; and
 Give greater reliability in operation.

Westinghouse Electric & Manufacturing Co.
 East Pittsburgh, Pa.



Auto-starter
complete



Auto-Starter with
cover removed



Westinghouse

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Easy to make, and easy to sell.

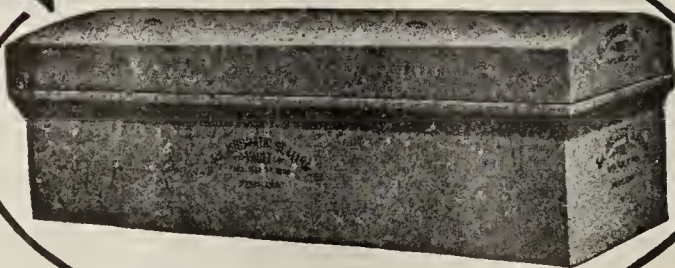
Automatic Sealing Vaults assure big profits and steady work.

You can make these vaults in your spare time, or start a business of your own. The only equipment necessary is a set of our Adjustable Steel Molds.

The Automatic Sealing Vault automatically seals itself when the cover is put on; and protects a burial casket forever against water, vermin, and decay. It is cheap enough for everyone and appeals to everyone.

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The Chain that puts the SHOVE
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MADE ONLY BY

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The Aero Pulverizer is a complete pulverized coal plant in one machine.

Built in five standard sizes ranging from 600 pounds to 5,000 pounds of coal per hour.

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In these days it isn't entirely a question of how much it will cost to replace worn-out equipment. It's more a question of whether or not you can get new equipment at all. It's therefore doubly essential that you take proper care of those machines you are now fortunate enough to have.

Plain and waterproof covers for all purposes. New and second-hand tents for sale or rent.

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Tents that turn the Rain. Paulins that really protect your machinery and material. Waterproofing that waterproofs.

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Three seconds!—and this bracket is up—safe and sure. No nailing, no slipping over the top of or cutting into the upright, no tightening of bolts. Simply applied to any part of the upright. The teeth on the dog plate grip like a bull dog—the heavier the load, the tighter the grip. These are the brackets you've waited for, MR. MASON CONTRACTOR.

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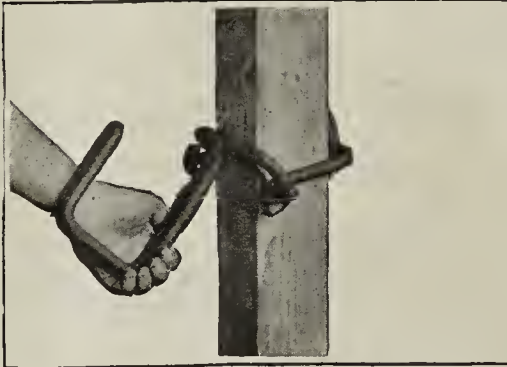
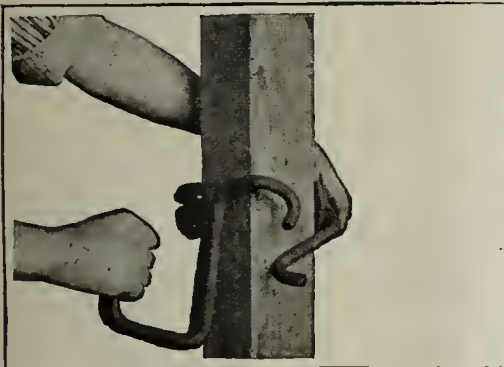
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You can't afford to turn a cold shoulder to a money-maker. Try a sample dozen. You'll wonder how you ever got along without them. Write right away for prices.

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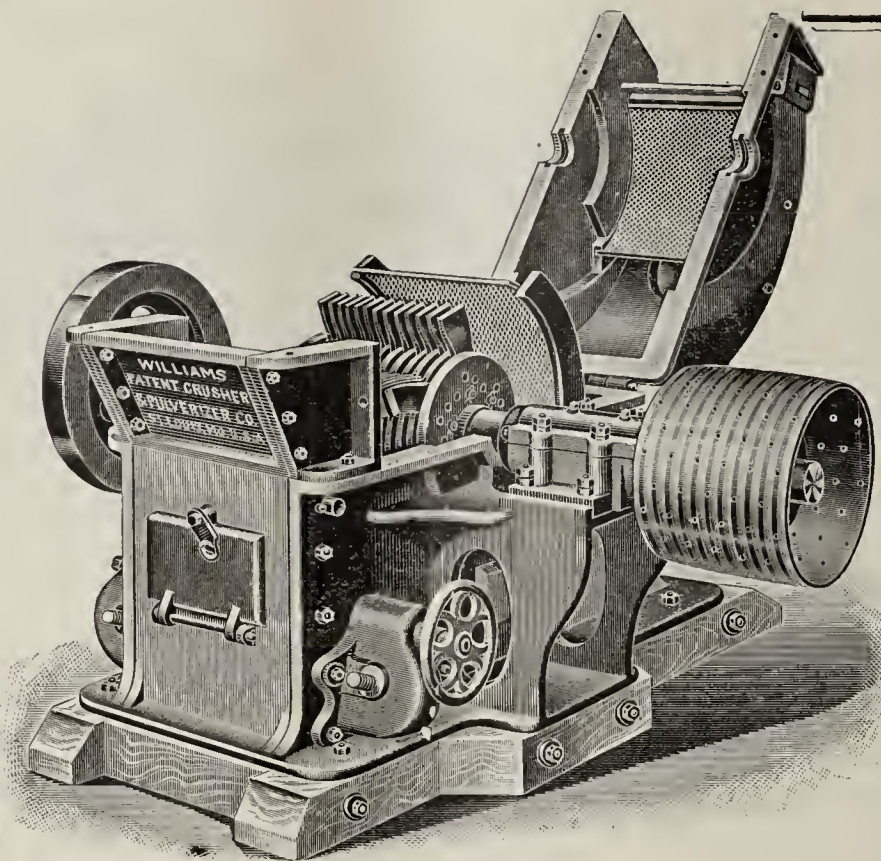
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Take 2 in. to 3 in. dry stone and in one operation, without outside screens or separators will produce 95% through 20-mesh material.

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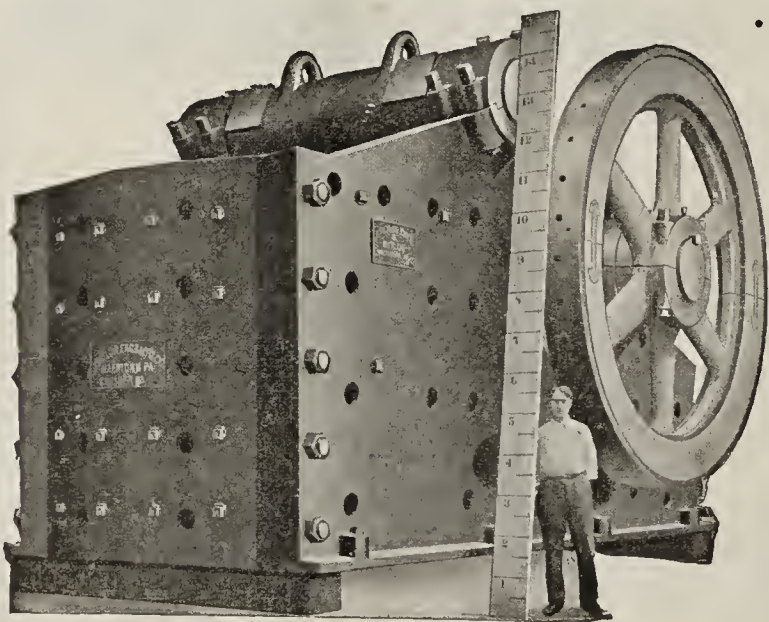
There is undoubtedly room in your plant for one of these machines, which, in the last twenty-two years have proven that they are money savers, can be depended on, and really have merit. If further information is desired, Write for Bulletin No. 17, which is brim full.

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Traylor 60"x86" All Steel Jaw Crusher

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Are Built in All Sizes from 7"x10" to 66"x86"

The 66"x86" is the largest crusher built.

All Traylor Jaw Crushers have cast steel water cooler pitmans.

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The last word in Gyratorys.

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Long or short for wet or dry grinding. Have water cooled bearings of extra size. Positive automatic feed that assures maximum tonnage for minimum horse power.

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For reducing lumps to fines in one step.

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CORDEAU-BICKFORD DETONATING FUSE USED IN THIS SUCCESSFUL BLAST



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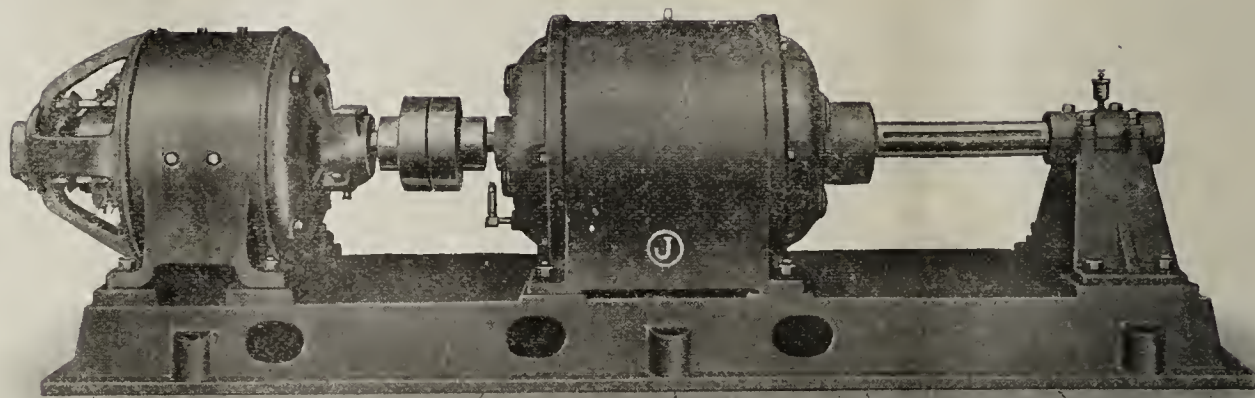
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Original Manufacturers of Safety Fuse.

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*Will Show
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THEIR first cost is not excessively high, installation costs are low, upkeep is a small item (just an occasional supply of oil), and they require no skilled mechanical attention. There are no belts to replace or tighten and no open gears to guard or renew. Jones Reducers transmit practically the full horsepower delivered by the driving motor, and comply with all safety laws. They are the cheapest in the long run.

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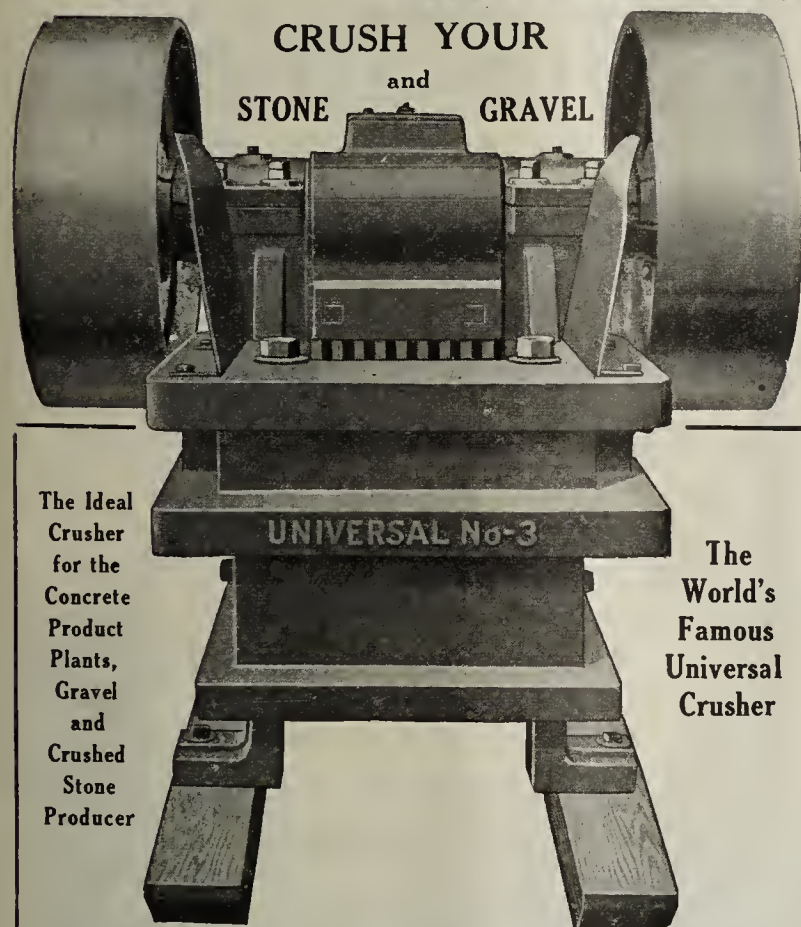
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**We Build Crushers from 5 Tons to 300 Tons
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Instantly adjusted to produce size required from
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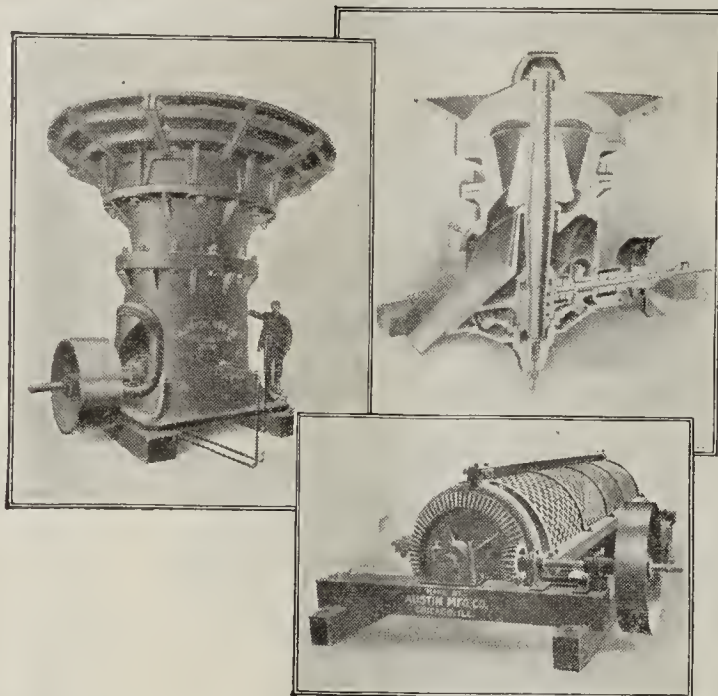
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The Kingsford Sand and Dredging Pumps are built in all sizes for Engine, motor or belt drive and can be furnished with or without linings.

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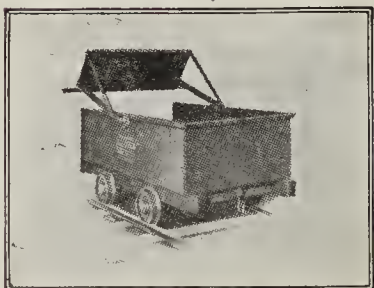
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When we are selling you an Austin Gyratory Crusher the more you probe into its internal construction, the more surely we feel that you will be convinced of the advantages of AUSTIN DESIGN. Austin gyratory features are substantial mechanical advantages, not merely "talking points."

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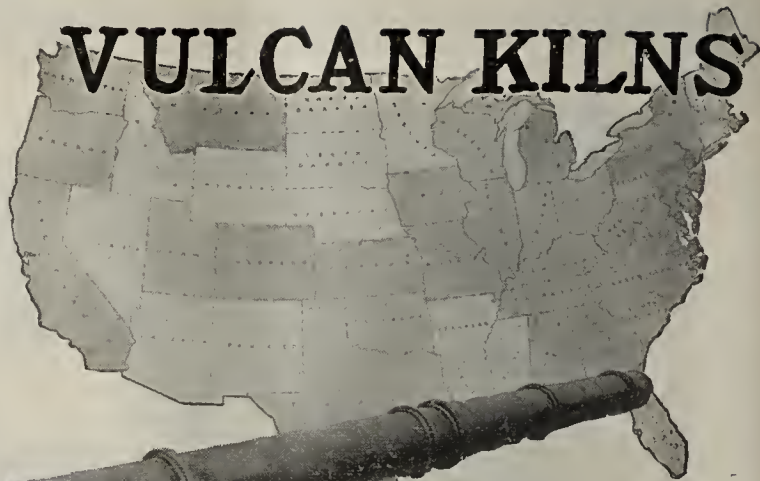
AUSTIN MANUFACTURING CO.

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VULCAN KILNS



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The call that came from coast to coast—
Let's Go!

We're Off! We're Going!

The wheels are turning, the gears are churning, the belts are flying, the mills are pouring forth their products to meet the demand for building materials. The increased building program means prosperity. Prosperity means bigger plants. If you have to increase the capacity of your plant it may be that you can lower your costs of production very materially by installing VULCAN Rotary Kiln. There are 65 different manufacturing and chemical processes where Rotary Kilns can be used to advantage.

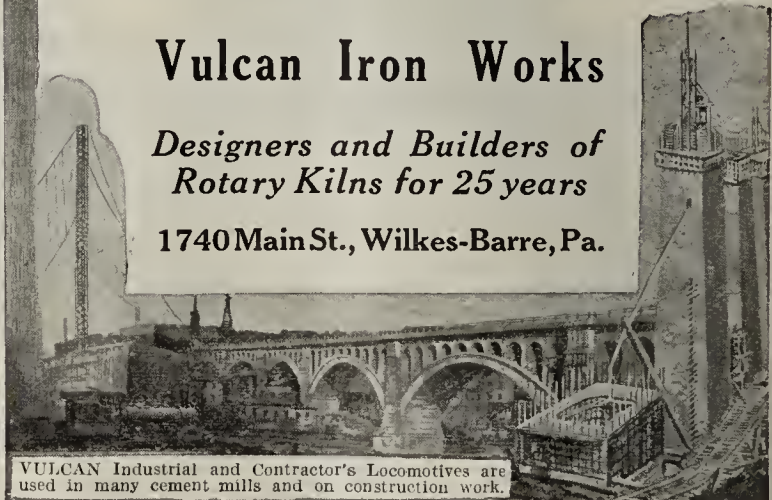
Consult your Chemist.

Correspondence Invited.

Vulcan Iron Works

*Designers and Builders of
Rotary Kilns for 25 years*

1740 Main St., Wilkes-Barre, Pa.



VULCAN Industrial and Contractor's Locomotives are used in many cement mills and on construction work.

STURTEVANT MILL CO.

HARRISON SQUARE - - BOSTON, MASS.

RING-ROLL PULVERIZERS

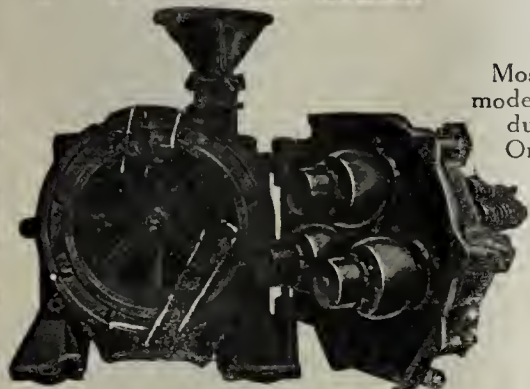
Most durable and efficient grinder for hard and moderately hard rock or ore. Used for the reduction of Cement-Clinker, Limestone, Quartz, Ores, Granite, Trap, Phosphate, Coal, etc., etc. Hundreds in use.

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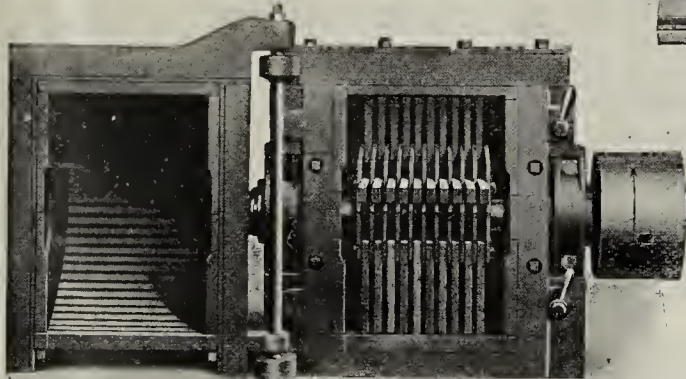


Ring Roll Pulverizer

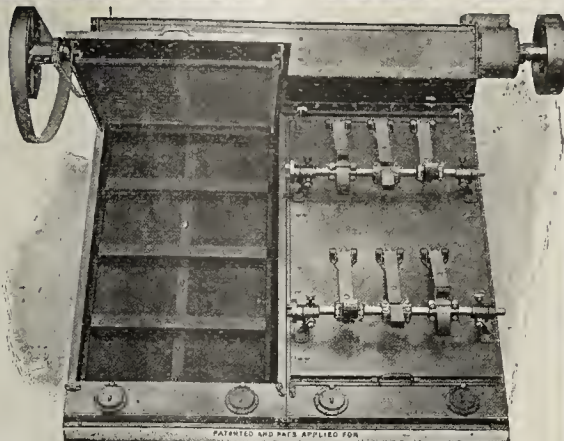
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Swing-Sledge Mill



Newaygo Super-Screen

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LINE OF
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AND MIXING MACHINERY

IN THE WORLD

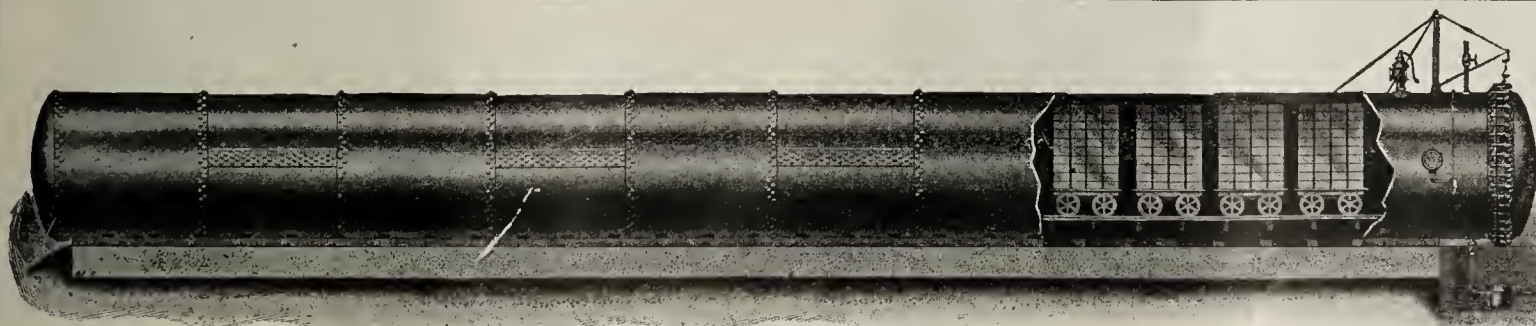
Send for Condensed Circular No. 60

Sand Lime Brick Machinery

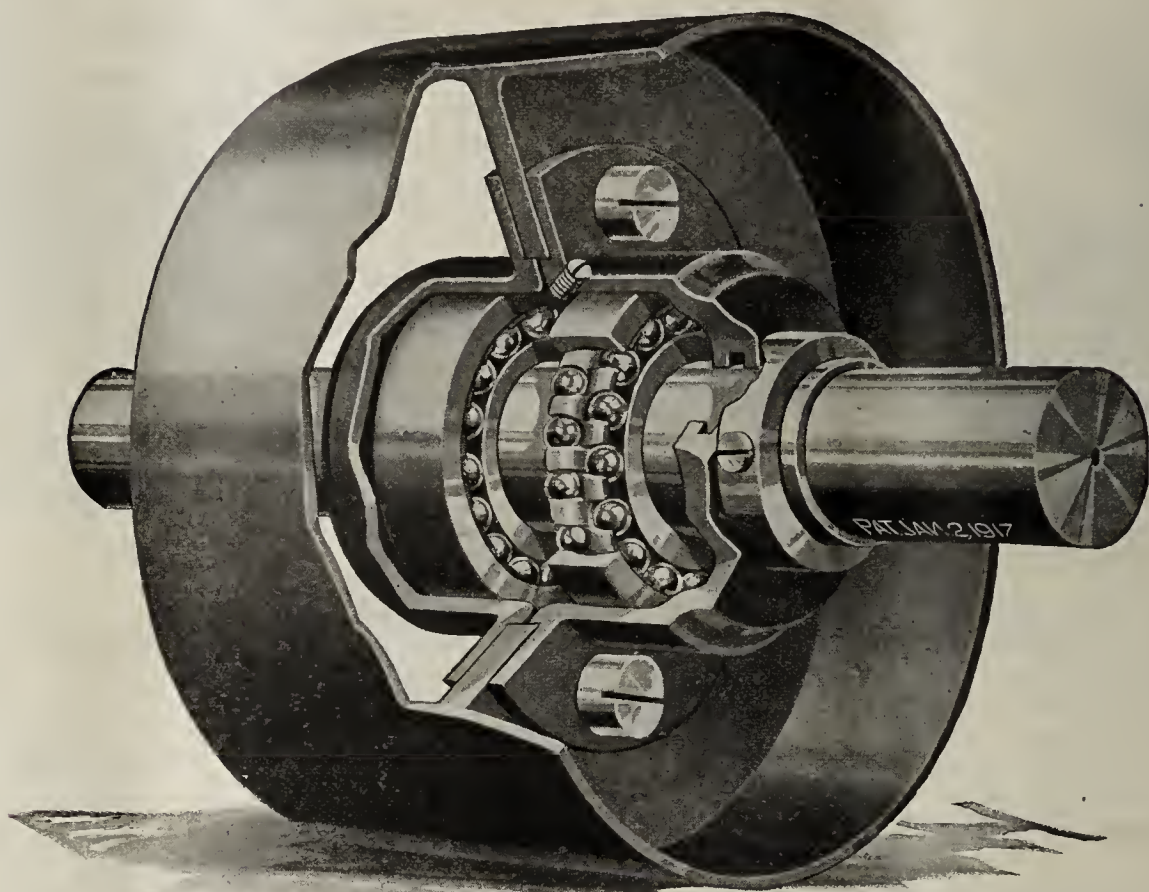
Our complete line of Sand Lime Brick Machinery makes it possible to secure just that machinery which is required to make your plant a success. We favor no particular type of machinery but are guided by the needs of the customer. Our wet and dry grinding mills have transformed a number of unsuccessful plants into dividend producers, while our Presses, Mixers, Hardening Cylinders and other equipment are of equal quality. We can exactly meet the demands of any manufacturer with a quality of machinery which will operate at a profit with a minimum amount of attention and expense.

Correspondence solicited

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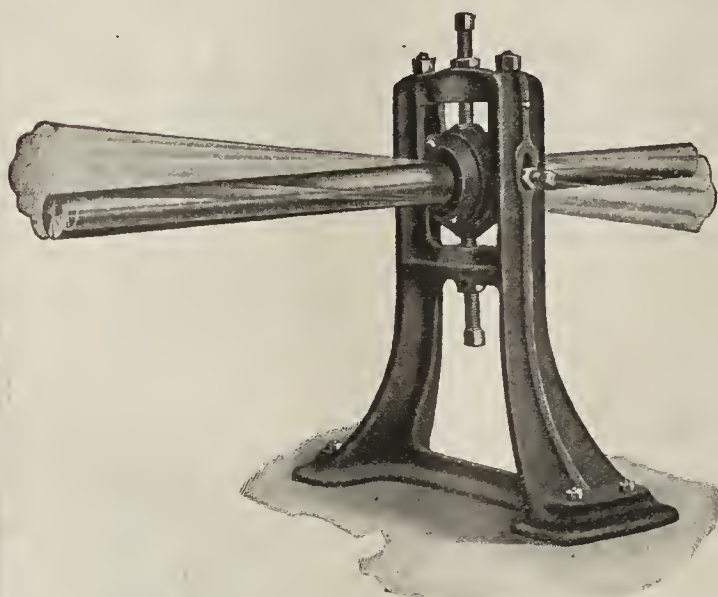
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SKF Ball Bearing Loose Pulleys



A Loose Pulley Guaranteed to Carry Any Belt Load at Any Speed Without Bearing Troubles.

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Investigate Our Line Shafting Equipment

Savings of thousands of dollars are being effected in plants by use of S-K-F Frictionless, Self Aligning Ball Bearing Hangers. They are correctly designed for maximum strength and conserve power that is otherwise wasted.

We Carry in Stock Wood and Steel Pulleys, Ball and Roller Bearing Drop Hangers, Ball and Roller Bearing Post Hangers, Ball and Roller Bearing Pillow Blocks, Collars, Couplings, Oneida Steel Pulleys, Elevator Buckets, Etc. Write for Prices and Catalog E.

FACTORY:
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Chicago Pulley & Shafting Co. 40 South Clinton St.
Chicago, Ill.

40 So. Clinton Street, CHICAGO

Pioneers in Ball Bearing Power Transmission Appliances.



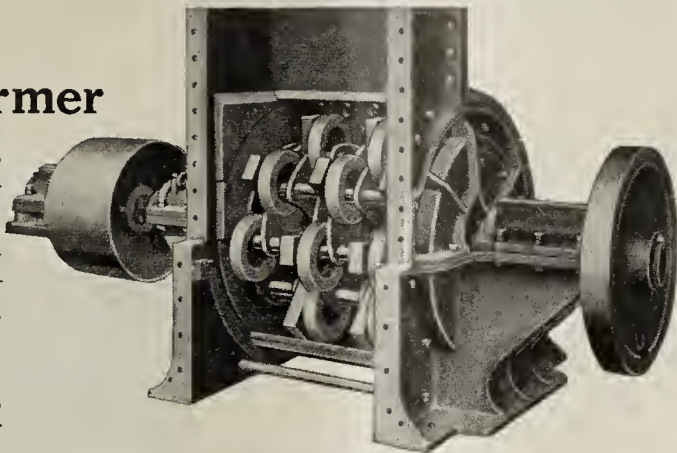
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Ring Pulverizers

are earning enormous profits for their users. The plant here shown paid five times its cost in profits in five months running. This is not an isolated instance. Many others have done equally well or better in producing

Limestone for the Farmer

The profits are large; the market far bigger than the supply. Install a guaranteed machine—An American Ring Pulverizer.



It's guaranteed. Cost of production is but 15 to 30 cents per ton when an American is used.

Furthermore, we guarantee our estimates of power consumption, production, wear and tear, upkeep, etc., before making the installation. You take no chances.

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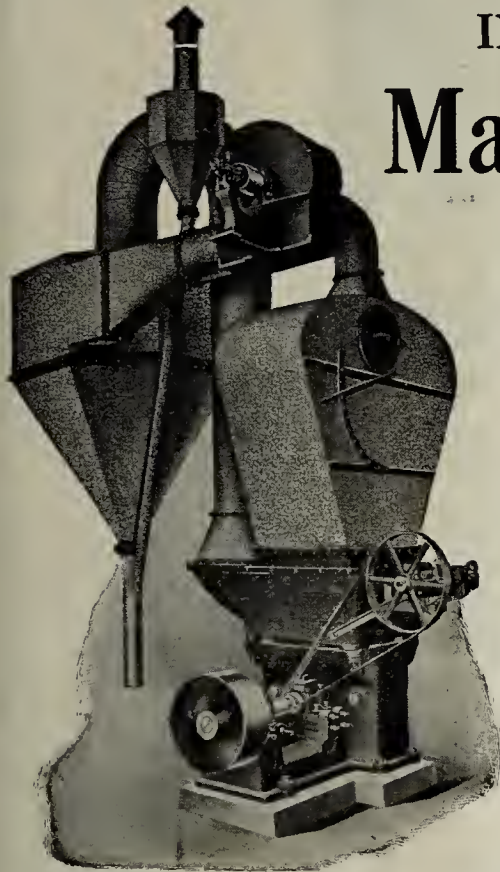
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"We Crush Everything—Why Can't You Do It?"

Complete Grinding IN ONE Machine



In successful use
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Cement, Clinker,
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NO DUST

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Problems up to a

BYERS AUTO-CRANE

Ask for BULLETIN 1015 Showing a Variety of Uses



Steam, Gasoline or Electric Power
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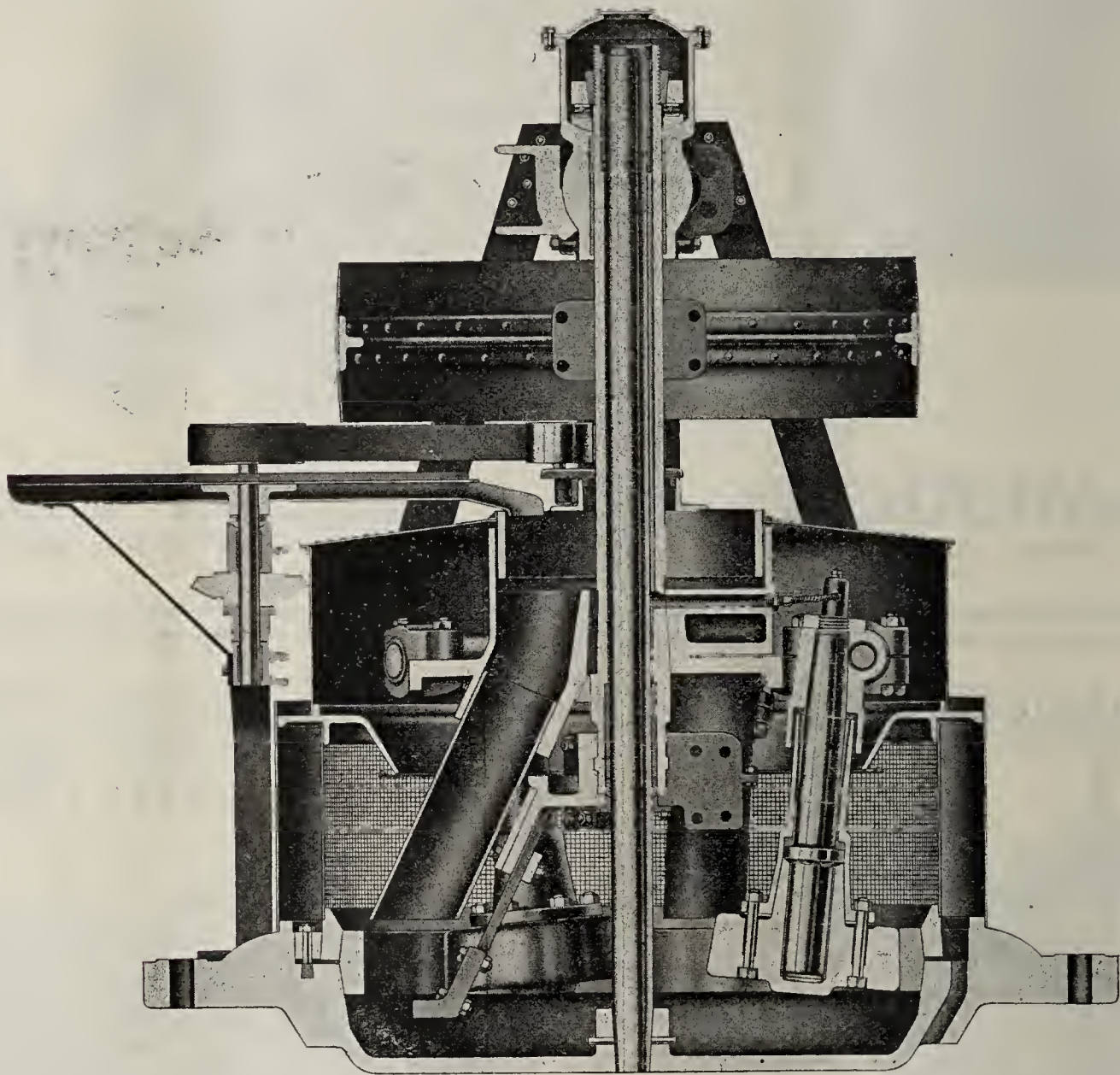
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The Bradley Hercules Mill Is Making New Friends Every Month

Now Twenty-Five of These Large, Successful Mills in Operation



Three new installations this month and wonderful reports from all old users indicate that this mill will soon displace all other preliminary pulverizers in cement plants.

Why not investigate now? Investigation will mean purchasing. It's the largest, simplest, most accessible and cheapest mill obtainable. Grinds to a fineness of 55% through 100 in single operation. This fineness will increase your tube mill output.

Save Power, Labor, Space and Money. Our engineers will gladly explain.

Bradley Pulverizer Co.

Boston

Works: Allentown, Pa.

London

Cement and Engineering News

Vol. 31

Chicago, September, 1919

No. 9



I started out to put to rout a bunch of Kansas counties; I felt the need, I did indeed, of picking up some bounties. "Forget your soup and fly the coop," I thundered at the people; "Your life's at stake, I'll leave a wake and spare no farm nor steeple." I picked up pigs and ancient rigs, I juggled Fords and Saxons; I sure raised hell, and did it well, by blowing all the Klaxons. Uprooted trees sailed on the breeze, while houses took a flyer; barns went larking, dogs a-barking, mounting high and higher. 'Twas sure a snap to change the map where wooden structures stood; but let me say, I've had my day—gone is the reign of wood. I do not know why all my blow should fail to leave a trace of passing harm, or e'en alarm, on concrete's haughty face. Gibraltar's rock could stand no shock more nobly, I am sure; the essence of worth and grit of earth have made concrete endure. And so, you see, they've made of me a baby weak as wood, they swiped my thunder so my plunder would not be so good. I ripped that town quite upside down, but concrete stood the gaff, while other stuff that was not tough I tossed around like chaff. Young farmer Brown of great renown no cyclone cellar had, he was not there, so in despair I hunted up his Dad. I could not scent the poor old gent to take him for a spin, so picked the farm upon my arm, hoping both were in. They put it over, yes, by clover! all the Browns got by, while Jersey stocks and Plymouth Rocks went sailing through the sky. I sure am stuck and out of luck, I missed 'em by a mile-O; the whole blame bunch they took a hunch and hid in their concrete silo.



Editorial

Causes of Present Prices of Cement and Other Building Materials

The construction material market is rapidly becoming a seller's market and it is logical to expect that during the current year there will be a rising price movement in practically all of the important construction materials. An official of the Turner Construction Company, of New York and Boston, was interviewed recently on the subject of present prices of materials used and should be read by all who are interested in the subject of economic influences affecting construction material costs. He said:

"Political economists and banking experts agree that, aside from any other cause, the immense issues of paper money, the large bond issues, which will be utilized for borrowing at the banks, and the credit expansion due to increased bank deposits would automatically maintain a very much higher level of prices than we had before the war. They point to similar periods in the world's history as examples. English and other European authorities seem more positive than our own, as the proportionate increase in prices and the bond issues were proportionately greater in those countries. Another important factor is the determination of organized labor to maintain wages and the actual scarcity of common labor which will hold the price of common labor up. They also state that it will be a great many years before foreign goods can be manufactured to take care of the European needs and leave a sufficient surplus to export to this country and disturb our local markets. It is hard for the ordinary business man to follow the scientific reasonings of the political economists, but if an analysis is made of the individual items which we use in construction it can be readily seen that there is no prospect of prices being reduced to the pre-war level, except as the commodity price level lowers gradually over a period of years.

Cement Prices and Conditions Governing Them.

"The price of cement at Eastern mills in 1913 was 85c a barrel without bags. One ton of coal would burn five barrels of cement. The mills had contracts for coal at 75c per ton previous to the war. For each one dollar that coal was advanced, the price of cement has automatically advanced about 20c. The price of coal is now probably around \$2 per ton at mines.

"The freight rates on coal have been advanced so that cement costs for fuel alone at least 30 cents more per barrel. The other mining the rock, in transporting to mill, in packing the bags, and loading cars. Where labor used to be 15 cents per hour it is now 40 to 45 cents. So that it can be safely said that the actual production cost must be double that of 1912-13.

"To the production must be added the overhead, which consists of depreciation and repairs, a heavy item in cement mills, interest on investment and selling expense. This item is practically constant whether the mills are running at full or partial capacity.

"During the last year they have not been running over 40 per cent capacity on the average, with a corresponding high overhead cost per barrel of cement.

So that the statement which has been made so that the mills showed a better return in the pre-war period at 85c per barrel than they now do at current prices may be substantiated. Under these conditions there seems to be a little likelihood of a reduction in price until the mills have been operating for some time at a higher percentage of capacity.

Sand and Gravel Prices

"Sand and gravel are dependent upon the cost of common labor and the cost of transportation. Both of these items have more than doubled since 1913. The sand and gravel plants during 1918 did practically nothing outside of government work, with consequent heavy overhead expenses, so that it is doubtful whether any material reduction can be expected in the sand price."

Lumber Prices Advance This Week

The f. c. b. mill prices of all items of yellow pine lumber have advanced from \$2 to \$3 during the week. Mill prices for douglas fir have also advanced. The increase in demand has caused the sharp increase in mill prices.

Lumber is dependent upon the cost and scarcity of the labor to cut the timber and upon the transportation rates. The lumber price in the South is practically double the pre-war figures. The common labor in the forests costs over twice the pre-war rate and is become very scarce. The lumber is being cut further away from the railroads, making it more difficult to ship. Freight rates have been increased 40 per cent, and the competition from sailing vessels is almost eliminated by the high cost of tonnage. It is true that the yards are adding a larger charge to the wholesale price for handling, storing and delivering, much of which can be saved at the present time, as freight from southern points is arriving promptly.

The Price of Steel and Brick

Steel has increased in price more proportionately than any of the other products. Producers claim that any reduction below present levels will force many mills to suspend operation. Wages have been advanced to much more than double the pre-war rates, and labor is becoming scarce. Fuel and limestone for fluxing are at least double former costs. The determined effort of the Railroad Administration to force down steel rail prices has not met with success, and the passing of the extra dividend on the common stock of the steel corporation would apparently show that it does not expect to make the profits at present prices that were made in 1918.

The cost of manufacture of brick has been greatly increased by labor and transportation costs, and no material reduction can be seen at present.

Add Five-Ton Trucks to Service

The Island Sand & Gravel Company, a subsidiary of the Columbus Consumers' Supply Company, of Columbus, Ohio, has purchased two five-ton trucks as addition to its equipment in delivering sand and gravel. The company also purchased a smaller truck to make deliveries for the building supply concern.

Handling Aggregate for Concrete Roads

Within the past few months CEMENT & ENGINEERING NEWS has described several concrete and road construction jobs where special methods have been used to reduce the labor required in handling the aggregate. Another piece of construction work where special equipment has reduced the number of men necessary to handle and transport the sand and stone for the concrete is a section of about $11\frac{1}{2}$ miles in St. Joseph County, Ind. This pavement is 18 feet wide, 6 inches thick at the sides and 9 inches at the center. The contractor for this work is Jacob Ackerman & Co., of Laporte.

Prior to the award of this contract this company had concentrated on brick and macadam paving and consequently were without the special equipment necessary to handle economically a large concrete road contract. The total cost of the road was about \$175,000. To handle a job of this size required the purchase of a large amount of machinery, and a paving mixer, forms, 3 miles of industrial railway, a locomotive and 45 standard $1\frac{1}{2}$ -yard cars and the special equipment necessary for this type of work were bought.

Instead of following the standard practice in regard to loading the aggregate into the cars, hauling it to the road and dumping it there to be fed to the mixer by wheelbarrows, the contractors devised a method whereby it was possible to mix concrete without moving the material by hand. Gravel and sand were delivered by railroad to bins erected along the track, the aggregate being discharged by gravity from the cars into a chute, whence it was raised by an elevator and discharged into the bins.

From the bins, which hold about 35 yards each, the sand and gravel were loaded by gravity into the dump cars, 15 cubic feet of gravel and 9 cubic feet of sand—enough for one batch of concrete—being loaded into each car. On top of this sand and gravel was deposited six bags of cement. Fifteen cars, loaded in this way, made up a train. This train was hauled to the mixer, which was equipped with a skip working at right angles to the drum and long enough for the industrial side-dump cars to discharge directly into it. The mixer is a special machine and has a capacity of 36 cubic feet and, as stated above, has a specially designed skip. The concrete is mixed $1:1\frac{1}{2}:2\frac{1}{2}$.

By handling the concrete material in this manner, a much smaller number of men is required to operate the mixer than would be the case if wheelbarrows were used to convey the sand and gravel to the mixer. No material is lost by scattering on the sub-grade, and there is no danger of getting earth mixed with the sand or stone. No cement pile is required with the attendant danger of waste by wetting, etc.

For grading, a steam shovel with a $\frac{5}{8}$ -yard dipper was used, especially on the heavier cuts. Teams were used for hauling, 35 being employed at times.

Driven wells furnish the water for mixing the concrete and curing the completed roads. Water is pumped by a 6-h. p. kerosene-driven engine through a 2-inch pipe line. The pipe line is provided with tees 150 feet apart for hose connections. The capacity of the water works system is about 18,000 gallons a day, and a pressure of 30 pounds is maintained, a pressure tank insuring a steady supply.

Bonding New to Old Concrete

Small-size tests on mortar and concrete specimens in direct tension, shear and cross-bending have led W. E. Rosengarten of the United States Bureau of Public Roads to the following conclusions (reported in the official paper of the Bureau, Public Roads, for June, 1919), regarding the practice in bonding old to new concrete:

By careful treatment new concrete can be made to adhere to old with a strength equal to 60 per cent of monolithic concrete. If a greater bond than this is desired it will be necessary to resort to dowels drilled into the old concrete.

If no special treatment is given the old concrete other than cleaning off foreign substances before adding the fresh concrete, a bond of but 20 per cent of the monolithic concrete is developed.

The surface of the old concrete can be roughened or treated with a 1:10 dilute solution of hydrochloric acid which will increase the bond by 20 per cent of the strength of the monolithic concrete.

A bonding medium of a thin layer of neat cement butter spread over the surface of the old concrete will increase the bond 20 per cent the strength of the monolithic concrete.

Tamping the fresh concrete hard against the old concrete, forcing the cement into the pores, increases the bond 5 per cent of the strength of the monolithic concrete.

The above conclusions refer to a rich concrete—namely, $1:\frac{2}{3}:1\frac{1}{3}$ —and for leaner mixes the percentages very likely would be increased.

The shearing strength of a joint is greatly increased by a treatment of the surface of the old concrete, and although it may slightly increase the cost of the work, the added effect would certainly seem desirable. The results of this series show that there is no danger of leakage at a joint made in concrete of a mixture as rich as $1:\frac{2}{3}:1\frac{1}{3}$, under pressures up to 40 pounds per square inch; when the surface of the old concrete has been treated.

A New Cement Mill to Be Built in Pennsylvania

Official announcement has been made that the Bessemer Limestone Co. plans to build a mammoth Portland cement plant of 300 barrels daily capacity at Bessemer, Pa., adjoining the quarry holdings of the company. This comes with announcement that the name of the company has been changed to Bessemer Limestone & Cement Co., and that it has been changed from a Pennsylvania to an Ohio corporation. Offices of the company have been in the Stanbaugh building, Youngstown, for some time.

The new company has an increased capitalization of \$2,000,000 and more than one million of this amount will be spent in construction of the new plant.

Incorporators of the company, as now formed under the laws of Ohio, are John Tod, Joseph G. Butler, Jr., John Stanbaugh, Fred R. Kanengeiser, John Reese Rowland and Rollin C. Steese. The total capitalization under the new arrangement is to be \$3,000,000.

The Bessemer Limestone Co. disposed of its paving brick plant at Bessemer over a year ago to the Metropolitan Paving Brick Co. of Canton, retaining its limestone quarries. Realizing the future for limestone and its by-products, the cement plant is now launched. As 75 per cent of the stock of the company is held in Ohio, it was transferred to an Ohio corporation.

With an annual capacity of over 1,000,000 barrels, the new company will employ a large force of men, and a boom for Bessemer is predicted.

Cement Producing Quick-Hardening Concrete*

In the course of the investigation which the Pittsburgh Branch of the Bureau of Standards has been conducting dealing with the various problems relating to Portland cement, there have been made a number of cements which are characterized by a very high early strength. This is developed when the cements are used either as mortars or concretes. These cements have been made in a manner differing in no wise from that used in the manufacture of Portland cement. However, the composition of the materials entering into their manufacture was decidedly different, limestone and calcined alumina having been used in some of the raw mixes, and in others the alumina was replaced in part by kaolin or bauxite in order to determine the effect of impurities on their general properties. While such materials have been the subject of research by others, especially Spackman, their property of developing very high early strengths is not generally known. It is believed that the data presented in this paper, especially that dealing with the concrete, are the first of their kind ever presented.

The data dealing with the aluminates are augmented by some obtained in making concrete from "Sorel cement" (a commercial product), which, as is generally known, is light calcined magnesite gaged with magnesium chloride. It has been unofficially reported that during the recent war the enemy used a concrete made of such a cement for "setting up" their large guns. As it obtains the greater part of its strength within 24 hours and as this strength equals that obtained by a Portland cement at the end of two or three weeks, the possibility of using it becomes very attractive. The data presented were obtained in making a limited number of concretes, but it is believed that such data, in so far as they relate to concretes, have never before been presented.

Concrete Made with Sorel Cement

At the present time this cement is used in rather large quantities for making a resilient flooring which is usually referred to as "composition flooring." When so used the aggregate is composed of asbestos fiber, sawdust, inert finely ground filler as sand and coloring matter. This flooring is widely used in a monolithic form in office buildings, passenger and subway cars and interior ship decks. Recently a mortar very similar in nature to the above, excepting the omission of the fibrous material, has been rather successfully used as a stucco.

The magnesia used in the present investigation was made from magnesite mined in California. It was a mixture of two shipments from two manufacturers of flooring. Both had given satisfactory results when used in flooring mixes. No data are at hand which would enable one familiar with Portland cement to form an

idea of the relative strengths which these would develop in the usual small briquette or compression specimen. The small specimens made were of a flooring composition and as such were composed of 50 per cent magnesia, 12 per cent asbestos, 10 per cent sawdust, 22 per cent ground sand and 6 per cent iron oxide, all by weight. This mixture when gaged with 52 per cent of a solution of chloride having a gravity of 1.1885 (about 23° Baumé), gave the following strengths in pounds per square inch:

Specimen.	24 hours.	7 days.	28 days.	90 days.
A { Tension	531	841	1,087	1,034
{ Compression	2,240	3,795	5,300	4,340
B { Tension	576	900	935	1,049
{ Compression	2,900	4,240	5,300	5,370

In Table I is shown the strength of the concrete made from this mixed oxide and also the compressive strength developed by a Portland-cement concrete using the same proportions of the same aggregates. Notwithstanding the fact that the specific gravity of the magnesia is very close to that of Portland cement (3.08 for the magnesia and 3.12 for the cement), the volume occupied by the same weight of the two differs very materially. As the magnesia weighed but 51 pounds per cubic foot, the actual percentage by weight of the magnesia in any one concrete was decidedly less than the percentage of Portland cement. For this reason the 1:6 concrete was proportioned both by weight and by volume, when the magnesia was used as the cementing material. All specimens were stored in the air until broken. The gravel used was obtained from the Allegheny River and was screened between a $\frac{1}{8}$ -inch and $1\frac{1}{2}$ -inch screen. It contained an excessive amount of the finer sizes. The limestone was a rather soft stone screened between the $\frac{1}{4}$ -inch and 1-inch screens. The "coarse sand" aggregate was sand from the Allegheny River screened between the $\frac{1}{8}$ -inch and $\frac{1}{4}$ -inch screens.

As the information sought had to be alone with early strengths, specimens were made for breaking at 24 hours, 48 hours and 7 days in the case of those made with magnesia and 48 hours and 7 days when Portland cement was used.

The results show that the Sorel-cement concretes, with but two exceptions, have a strength at 48 hours greater than that obtained by the use of Portland cement in 7 days. However, it is also seen that there is in general but little increase in the strength of the former between the 48-hour period and the 7-day period. The results obtained at all periods from the Sorel-cement concrete proportioned by weight are generally higher than those obtained when the proportioning was done by volume, regardless of what the proportions were. This clearly shows that for such a light material the proportions should be decidedly different from those generally used with Portland ce-

TABLE I—COMPARISON OF COMPRESSIVE STRENGTHS OF SOREL AND PORTLAND-CEMENT CONCRETE.
6 by 12-in Cylinders. Strength in Pounds Per Square Inch.

Proportions by volume.	Percentage of cement by weight.		24 hours.		48 hours.		7 days.		Per cent H ₂ O in Portland-Cement Concrete.	Per cent MgCl ₂ in Sorel-Cement Concrete.
	Portland.	MgO.	Portland.	MgO.	Portland.	MgO.	Portland.	MgO.		
1:0.5:1.5	33.3	20.3	.....	1,740	1,570	3,490	2,965	2,910	12.1	14.7
1:1.0:3.0	20.0	11.3	.....	1,705	1,115	2,260	2,020	2,850	7.8	9.5
1:1.5:4.5	14.3	7.8	.....	1,755	680	2,145	1,430	2,240	7.9	9.8
*1:1.5:4.5	.....	14.3	.....	2,880	.....	3,315	.....	2,720	.....	12.1
Limestone Aggregate.										
1: $\frac{2}{3}$:1 $\frac{1}{2}$	35.2	21.8	.....	2,985	2,260	3,990	3,930	4,320	12.2	18.5
1:1 $\frac{1}{2}$:2 $\frac{1}{2}$	21.4	12.2	.....	1,940	1,340	2,805	2,990	2,970	9.9	13.7
1:2 :4	15.4	8.5	.....	1,935	655	2,330	1,755	2,480	9.5	12.8
*1:2 :4	.....	15.4	.....	3,270	.....	4,020	.....	4,320	.....	13.7
Coarse Sand Aggregate.										
1:0.5:1.5	34.0	20.8	.....	2,060	1,715	2,570	3,270	2,735	13.2	20.0
1:1.0:3.0	20.6	11.6	.....	1,910	545	2,225	1,635	2,430	11.4	16.0
1:1.5:4.5	14.7	8.0	.....	935	325	1,695	985	1,870	11.4	14.7
*1:1.5:4.5	.....	14.7	.....	2,355	.....	3,260	.....	3,190	.....	15.7

Note—The percentage by weight of MgO in 1:0.5:1.5 and 1: $\frac{2}{3}$:1 $\frac{1}{2}$ is but very little greater than the percentage by weight of Portland cement in 1:1.0:3.0 and 1:1 $\frac{1}{2}$:2 $\frac{1}{2}$, respectively.

*MgO proportioned by weight, making weight percentage of MgO equal weight percentage Portland cement in 1:1.5:4.5 and 1:2:4.

*Abstract of a paper presented at the 22nd annual meeting of the American Society for Testing Materials, held at Atlantic City, June 24-27.

ment. It would seem as if too much magnesia was used in the rich concretes and too little in the lean ones when the proportioning was carried out by volume.

Attention should be called to the difference in the manner in which the hardening of the two concretes takes place. In a Portland-cement concrete, the cement hardens by the action of the added water. During the process of hardening it is immersed in an atmosphere containing in a greater or less degree one of the essential elements of the process, that is, water either as a liquid or vapor. On the other hand, in the Sorel-cement concrete the hardening takes place as a result of the action of the chloride on the oxide. The chloride is always essential but any deficiency, as for instance the use of a too dilute solution, or any marked excess, is injurious. Therefore, not only the ratios between the aggregate and the magnesia must be studied, but also the ratio between the chloride and the magnesia.

While the results do show the lack of proper proportioning of both the magnesia and the chloride, yet these poorly proportioned concretes show in 24 hours as high strengths as the more properly proportioned Portland-cement concretes show in seven days. Another point should be remembered in regard to these Sorel-cement concretes, that is, they cannot be frozen. Temperatures below freezing will retard the hardening to a degree, but the freezing point of the solution is so low that no care need be taken to prevent damage from low temperatures.

Concretes Made with Calcium-Aluminate Cement

The calcium aluminates were all made in the experimental rotary kiln of the Bureau. The composition of these, the constitution arranged in order of the amounts present, and the temperatures of burning are given in Table II. The fineness and the time of setting* are given in Table III.

*In carrying out the investigation presented here, no addition of SO_3 in any form was made to cements. Work carried on at the same time as this presented here showed that such additions accelerated the time of set and caused a reduction in both the tensile and compressive strength.

With the exception of cement No. 6, no particular difficulty was encountered in burning. On account of the composition of this cement, its position in the ternary system $\text{CaO}-\text{Al}_2\text{O}_3-\text{SiO}_2$ was such that it was located in a field having both a low burning temperature and also one in which the orthosilicate predominate. This combination always produces a material which fluxes at such a temperature that the silicate on cooling reverts to the γ form from the β form of the silicate. This reversion is manifested by the "dusting" of the clinker. It was possible to produce this particular cement only either in a decidedly underburned condition, or overburned to such a degree that it fell from the kiln in large, soft balls, which dusted on cooling unless quickly water quenched. The latter procedure of burning, without quenching, was used. Cement No. 4 was made from a very hard clinker, but the latter did not show any tendency toward dusting. The clinker of the other cements was of the porous character of normal Portland clinker. Those low in iron oxide were white to yellowish in color; none of them had the glistening black appearance of Portland clinker, the darkest being a dark reddish brown. The raw materials used were calcined alumina and limestone for cements Nos. 1, 2 and 8; in Nos. 3, 4 and 5 the same materials were used, but part of the alumina was replaced by kaolin, thus reducing the alumina content of the mix but increasing the silica content. In No. 6 it was necessary to add some very finely ground flint, in order to secure the desired silica content, in addition to the kaolin, alumina and limestone,

and iron oxide. In No. 7 bauxite, limestone and iron oxide were the raw materials.

Reference should be made to the work of Rankin and the author, for further information in regard to the general properties of the constituents of these cements. For this present paper dealing more particularly with concrete made from them, it is not desirable to give more in regard to their properties than their reaction with water. Those aluminates indicated in Table II, as being present in these cements, all react with water to form the hydrated form of $3\text{CaO} \cdot \text{Al}_2\text{O}_3$. Such a reaction requires the formation of hydrated alumina. The amount of the latter will depend upon the amount of the alumina in the cement, consequently

TABLE II—COMPOSITION, CONSTITUTION AND TEMPERATURES OF BURNING OF CALCIUM-ALUMINATE CEMENTS.

All Composition in Per Cent.								
Cement No.	1	2	3	4	5	6	7	8
SiO_2	0.44	0.76	9.41	10.48	17.23	17.38	11.33	0.68
Al_2O_3	62.31	61.25	55.09	46.71	39.96	30.52	47.66	74.11
Fe_2O_3	0.51	0.60	2.04	2.13	2.57	1.85	3.10	0.40
CaO	36.69	36.32	30.73	39.79	38.84	46.72	34.87	23.82
MgO	0.36	0.48	2.95	1.04	1.29	2.27	3.66	0.81
Ignition loss	0.07	0.50	0.08	0.32	0.14	0.78	0.17	0.38
	100.38	99.91	100.30	100.47	100.03	100.52	100.19	100.20

Temperature of burning, deg. Cent.

1460 1480 1490 1380 1455 1360 1445 1500

Constituents¹... { 3C5A CA CA 2CAS 2CAS 2CS 2CAS CA
CA 5C 3A3C 5A CA CA 5C 3A CA 3C 5A
2CS 2CS 2CAS 2CS 2CS CA 2CS 2CAS

¹C = CaO; A = Al_2O_3 ; S = SiO_2 .

TABLE III.—TIME OF SETTING AND FINENESS OF CALCIUM-ALUMINATE CEMENTS.

Cement No.	Initial Set		Final Set		Per Cent Passing 200-Mesh
	Gillmore, hr. min.	Vicat, hr. min.	Gillmore, hr. min.	Vicat, hr. min.	
1.....	0 55	0 25	4 45	2 10	83.0
2.....	0 30	0 12	2 0	0 50	80.0
3.....	6 25	5 15	*	7 0	81.2
4.....	0 25	0 7	3 30	1 15	78.0
5.....	0 40	0 15	4 45	3 15	80.2
6.....	0 7	0 2	0 45	0 12	76.4
7.....	6 0	3 45	*	*	79.8
8.....	7 0	3 30	*	*	86.6

*Final Set between 8 and 16 hours.

the $3\text{CaO} \cdot 5\text{Al}_2\text{O}_3$ will give the most and the $5\text{CaO} \cdot 3\text{Al}_2\text{O}_3$ the least. This hydrated alumina is, as is well known, a colloid and, when formed under the conditions indicated above, constitutes the greater part of the cementitious material of these compounds.

The higher the alumina content in any of the aluminates, the slower will be the reaction with water and consequently the slower will be the time of setting. This is shown in Table III, but not very clearly unless studied in connection with the relative amounts of the constituents shown in Table II. The former table shows that cement No. 3 has a slower setting time than cements Nos. 1 and 2, and also a lesser alumina content. The latter table, however, shows the presence of a large amount of silica and therefore the presence of a quantity of silica which reduces the amount of alumina in the former cement and also retards the setting time. The two silicates present in these cements react very slowly with water, in fact, the ternary compound $2\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot \text{SiO}_2$ reacts so slowly that it will not form a cementing material, while the orthosilicate, $2\text{CaO} \cdot \text{SiO}_2$, at the end of a year shows but little more than 5 per cent water of hydration but a very satisfactory strength. Also a comparison of cement No. 8 with cements Nos. 1 and 2, or cement No. 7 with Nos. 5 and 6 will confirm the statement that increasing alumina content gives a slower setting cement. This has been more strikingly shown in other work carried on with the pure compounds when it was found that the tricalcium aluminate—the aluminate lowest in alumina—always gives a flash set.

With the exceptions of cements Nos. 2, 3 and 8, the burning temperatures used were either those generally used in burning Portland cement or a little lower. The temperatures used in these three exceptions were not much in excess of that infrequently used in making the latter cement and can be comparatively easily reached in a rotary kiln. One point in particular should

be noted: It is impossible to produce an unsound cement unless a temperature far below that used in Portland cement practice were attempted. Slight underburning or burning at a temperature of 100° lower than that given would have produced an aluminate lower in alumina and free alumina.

Table V shows the strengths produced by the cement when tested in the form of a 6 by 12-inch cylinder as a 1:1½:4½ gravel concrete. In order that some idea may be obtained in a comparative way of their deportment as a mortar, the compressive strengths of some 1:3 standard sand 2-inch cubes are given in

tively short time such an excess of the latter that there is a reduction in strength. It will not take up enough from air of the usual humidity to materially affect the strength. It does, however, lose water to the latter to a certain extent. It is this latter loss of water with consequent drying out of the colloid which causes the increase in strength of the water-air or damp closet-air storage over the storage in the water or damp closet alone.

It is interesting to note that in the case of the mortar specimens, cements Nos. 3, 5 and 6 developed the highest strengths by the combined method of storage

TABLE V.—COMPRESSIVE STRENGTH OF 1:6 AND 1:12 GRAVEL CONCRETE, FROM CALCIUM-ALUMINATE CEMENTS.

Tested Proportions ²	24 Hours.		All values in pounds per square inch.		7 Days.		28 Days.		90 Days.		26 Weeks.		1 Year	
	1:6	1:12	1:6	1:12	1:6	1:12	1:6	1:12	1:6	1:12	1:6	1:12	1:6	1:12
Cement No.														
1.....	2825	....	3270	....	3310	....	4150	....	4180	....	3310	5590	....	....
2.....	3000	....	4150	....	4740	....	2480	....	1760	....	1760	2360	....	....
3.....	Soft	....	2175	....	3680	....	3900	....	4525	....	4135	5660	....	....
4.....	3145	880	3570	1005	3370	1000	2930	875	2565	800	2965	3280	860	1275
5.....	310	Soft	885	225	1250	365	1050	390	1270	550	1460	2110	570	870
6.....	840	275	765	275	990	305	1260	400	1515	470	1440	2035	470	810
7.....	1475	455	4135	1405	4625	1500	4640	1600	4450	1580	4650	5300	1350	1815
8.....	2930	890	6010	2270	7060	3415	7050	3980	7610	3910	6720	8220	3930	4445

¹All specimens in these columns were stored for the first 4 months in the damp closet and for the remainder of the period in the air of the laboratory. All other specimens were stored in the damp closet for the entire period aged.

²Contained 3 per cent plaster.

Table IV. Previous work showed that, on account of the large amounts of colloidal material formed in the process of hardening, retrogression is likely to be shown by any specimens stored continuously in water or the damp closet. At certain periods, therefore, some of the specimens were removed from the water or damp closet and placed in the air of the laboratory until broken.

These two latter tables very clearly show the high 24-hour strengths. Special mention should surely be made of strengths of 2,800 to 3,100 pounds per square inch for a 1:6 concrete at the end of 24 hours. The strengths of some of the 1:3 mortars at the end of the

TABLE IV.—COMPRESSIVE STRENGTH OF 1:3 STANDARD SAND MORTARS, FROM CALCIUM-ALUMINATE CEMENTS

Tested at 24 hrs.	All values in pounds per square inch.							
	7days.	28days.	28days.	90days.	26 weeks.	1 yr.		
Cement No.	Water	C. S.	Water	Water	C. S.	Water		
1....	3570	5945	3765	6815	3945	5330	6015	3045
2....	4260	4760	3945	7625	4735	4570	5290	4430
3....	2240	4940	6475	8000	7180	7760	11050	5315
4....	4410	4880	5285	6400	4565	3470	3480	3200
5....	1035	1400	1820	2875	2070	2900	3845	2410
6....	1340	1260	1425	3130	1680	1895	4345	2310
7....	2165	5140	3930	7085	5205	3605	6090	5225
8....	2860	8610	7845	10690	8260	6380	8045	8945

C. S. = Stored for one-quarter of period in water and the remainder in the air of the laboratory.

same time is just as unusually high. The gain in strength with aging is also quite large although maximum strength is reached at a comparatively early period. Consequently some very phenomenal strengths for either kind of a specimen are developed. A compressive strength of 8,610 pounds per square inch at seven days for 1:3 mortar or 6,010 pounds at the same period for 1:6 concrete are surely striking. While these results represent some of the maximum ones obtained, there are many other very exceptional high strengths shown in the tables, when these are compared with the results generally obtained with Portland cement.

An examination of the tables shows that the maximum strength for the water or damp closet stored specimens was attained at some period previous to one year. As stated before, the quick hardening is due to a great amount of hydrated material rapidly formed. This is also in the colloidal form and will, therefore, in the presence of excess water, take up in a compara-

at the end of the 26-week period, while the other cements developed their maximum strength by this method of storage at 28 days. Apparently, therefore, the latter were much quicker hardening than the former. Concrete specimens aged by the combined method were broken only at the one-year period. At this period by this method of storage maximum strength was developed by all the cements except Nos. 4 and 2. These latter developed maximum strength by damp closet storage at 7 and 28 days respectively. The continued storage of these two in the damp closet until removed to the air apparently caused such excessive hydration that subsequent drying out could not cause sufficient gain in strength to bring back the maximum strength shown at the earlier period.

After the high results of the 1:6 concretes were obtained it was thought desirable to make some leaner concretes. Consequently a 1:3:9 gravel concrete was made, using certain of the cements of which there was a sufficient amount available. Even such lean concretes developed surprising strengths in several cases. This is especially true of cement No. 8, which developed a strength of 3,415 pounds per square inch at 28 days and 3,980 pounds at 90 days, and a maximum strength by the combined storage, of 4,445 pounds per square inch at one year.

In conclusion it may be stated, therefore, that the aluminates of lime, even when they contain such amounts of impurities as 10 per cent silica and 3 per cent iron oxide, constitute a material which is a very valuable cementing medium when gaged with water. This particular value lies in the high early strengths which they develop. The greater the amount of the alumina present, as an aluminate of lime, the greater will be the early strength. Under certain conditions of curing there is a marked increase of strength with age, but this does not extend over a very long period of time. It also appears that if the concrete is subjected to an excess of water during curing there will be a decrease in strength. Such amounts of moisture as are usually present in the air do not materially affect the strength. It appears, therefore, that these cements might be of considerable value for certain special uses, where the principal requisite would be quick hardening.

Run of 1200 Yards in Twenty Hours Made With Conveyor System for Concrete Aggregates

Gravel and Sand Came in Bottom-Dump Cars—Ce-
ment Handled Directly from Cars to Three Mixer
Units Building Large Grain Elevator

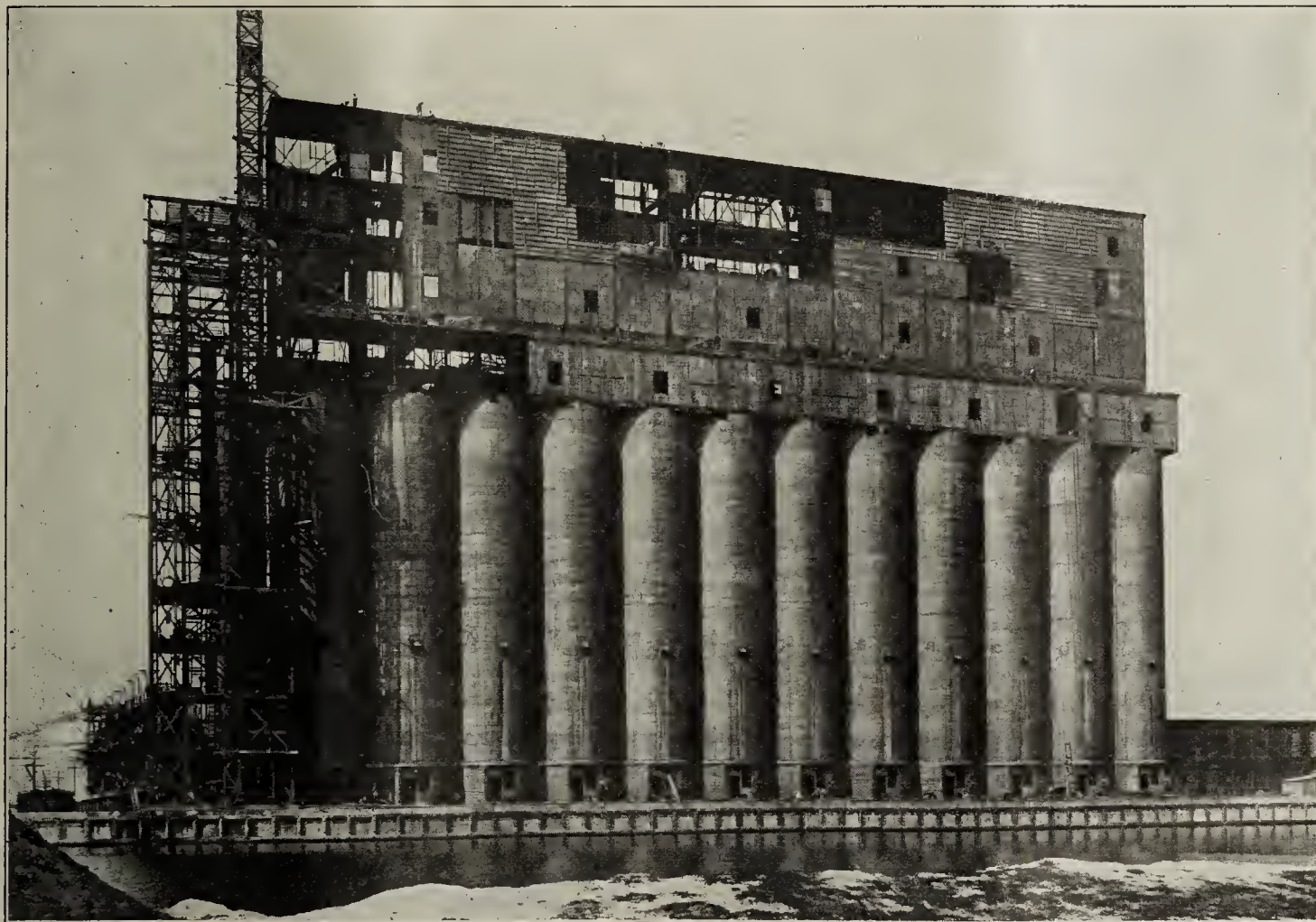
A record of 1200 cubic yards of concrete deposited in twenty consecutive hours was made August 23, on the new 6,000,000-bushel grain elevator which the Chicago & North Western Railway Company is building for the Armour Grain Company at 124th Street and the Calumet River, Chicago. There are in the storage portion being built at present 104 circular bins, 105 feet high and 22½ feet in diameter. They are being constructed by the continuous rising-form method. The entire bank of 104 tanks, aggregating 168 yards per vertical foot, was under construction when the record was made. Sand and gravel were supplied to the mixers by mechanical equipment that eliminated all hand work, and to this fact the contractor attributes the success of the concrete plant. Belt conveyors carry the aggregate from the bins into which bottom-dump cars discharge to the charging bins over the mixer, but there is an intervening "storage reservoir" of 2800 yards capacity between the cars and the mixer, so that any temporary irregularity in the supply of material is equalized.

mixer storage bin. A track with a continuous platform along the line of the mixers enables the supply of cement to be maintained with little use for the small 600-barrel sheds placed for emergency near each plant.

Handle Bottom-Dump Cars Quickly

Beginning at the aggregate end, bottom-dump cars, three at a time, are hauled up a slight incline by a one-drum 22 h. p. electric hoist over four hoppers. From one of them the material drops directly on to a 315-foot, 24-inch conveyor delivering to the storage bin. This runs at 300 feet per minute up an incline on a 20-degree slope and has a capacity of 200 yards per hour. The three other hoppers under the cars feed a belt running parallel with the track and discharging on the main supply conveyor. Two cars may be dumped at one time, and as many as five cars have unloaded per hour. The heat was so intense this summer that a shed had to be built over the unloading outfit.

The belt over the storage bin is 36 feet above ground level and a traveling tripper works back and forth dis-



New Concrete Grain Elevator

Concrete Supply Plants

There are three complete concrete plants erected in a line at the south end of the bank of tanks. Parallel with this line and 150 feet farther to the south is the "reservoir," a 200-foot length of material bins supplied at the west end by a track running north and south. A cross belt conveyor connects the storage bins with a conveyor running over the top of each individual

tributing the sand and gravel evenly over the length of the respective bins. The gravel bin holds 1800 yards and the sand bin 100 yards. A second belt, 4 feet above ground, draws from the storage bins, which were built entirely above ground on account of the boggy nature of the site, and discharges on the cross-conveyor. The latter elevates the material about 40 feet and discharges it either directly into the central-

plant hopper or onto belts running to the plants at each end of the line.

Each concrete unit consists of a 140-foot, two-compartment tower, a 1-yard Boss mixer, and a system of chutes with a swivel leg and balanced cantilever discharge spout reaching a maximum of 100 feet from the tower. Aggregate bins of 40 and 80-yard capacity for sand and gravel respectively deliver into the mixer through measuring chutes, and in less than a minute a bucket of concrete is mixed and shot up the tower at the rate of 300 feet per minute by a 90 h. p. special Thomas elevator hoist.

Water for the mixers was supplied from the river by means of a 4-inch triplex pump driven electrically by a starterless motor controlled by an automatic cut-off switch. The service was such as to start the pump operating every few minutes to keep up the required 80-pound pressure.

Distribution of Labor

The distribution of men engaged in the concreting process is as follows: Eight men unloading cars, three men attending to the conveyor belts, six men handling cement; and for each plant in use two men manipulating levers for aggregate and water; one man on the hoist; and one man on the top of the tower. The number of men handling chutes, spreading concrete and manning the jacks to raise the forms varied too much to give accurately.

It is to be noted that the 1200-yard record was made with only one mixer outfit, which operated continuously two 10-hour shifts, or a total of 20 hours.

During the extreme dry and hot weather the 315-foot main supply cotton belt stretched to an extent which could not be compensated for by the take-up and which proved a source of annoyance. To obviate this difficulty wetting of the under side of the belt with a hose was resorted to. This proved efficacious, and thereafter the belt was thoroughly wetted every three days for a period of two hours.

The whole job is operated by electricity, a temporary transformer station to bring the 12,000-volt current of the Commonwealth Edison Company down to 220 volts being erected just outside of the limits of the work. A switchboard backed by asbestos, controlling all circuits, is located in the same shed with the central concrete elevator hoist.

The Witherspoon-Englar Company and Grant Smith & Company are the general contractors for the elevator.

New Type of Hollow Concrete Wall Construction

A new type of hollow concrete wall construction has been devised by J. H. Cresmer, of the Cresmer Manufacturing Company, of Riverside, Calif. Mr. Cresmer's invention is still in a preliminary stage but he has applied for patents on the ideas which he has already developed. He has been studying for many months the problem of building economically a hollow concrete wall and, being a practical and successful builder, his ideas have been developed along practical lines. An experimental wall has been built at the Cresmer plant in Riverside and the inventor has satisfied himself that he has made distinct progress, if he has not reached an ultimate solution of the problem.

Most of the inventions for hollow concrete wall construction have been based on the unit system; that is, the forming of hollow wall by casting the walls in

sections and setting them in place. By his system walls are poured the same as for any concrete wall. Economy in construction is secured by simplifying form work and saving concrete by leaving vertical voids in the wall.

The voids are produced by collapsible steel forms which can be quickly put in place and just as quickly removed. These forms have a cross section resembling a flattened ellipse, with extreme dimensions 3x14 inches. They are made of two pieces of sheet steel bent into a "U" shape and fastened together at the vertical edges by steel buttons working in slots, which permit the form being contracted half an inch in its longest sectional dimension. The vertical edges of the two pieces of the form are attached to a strip of wood, 3x3 inches, cut diagonally in two sections, extending through the center of the form and making it rigid. When the two sections of this piece of wood, which extends above the form, making a handle for it, are set to make a perfect square, the form is extended to its greatest dimensions. In this shape it is clamped within the wall forms. A vertical groove runs the length of each of the oblique faces of the strip of wood and a flat steel rod, set in the groove and twisted, causes the oblique faces to slide on each other and contract the form longitudinally one-half inch and transversely three-eighths of an inch. When the concrete in the wall has set, the steel form is readily removed by inserting the steel rod and twisting it. This operation contracts the form in all its dimensions and pulls it away from the concrete. The steel rod used to twist the form and cause it to collapse, is bent at right angles at one end, forming a lever by which the rod can be easily twisted. The whole operation of setting and removing the form is very simple and can be done quickly.

Simplicity of handling is also a feature of the outside wall forms. No nails are used to fasten them in place. The top end of each board fits in a V-shaped groove in a horizontal timber and a movable metal cleat on the bottom end of the board fastens it to another horizontal timber, these timbers forming the frame of the form. The horizontal timbers on each side of the wall are fastened together with wires, one end being attached to a steel button and the free end being bent over another button when the wire is in place. When these outside forms are removed the boards are taken out first, the movable cleats being raised at the bottom, allowing the board to drop out of the groove in the timber at the top.

The outside forms and the steel core forms have a depth of about three feet. Two sets of outside forms will be used, one remaining in place while the next section of the wall is being poured. The boards may be used many times, practically the only waste being in the horizontal timbers which hold them in place, it being necessary to cut these to fit each length of wall constructed. First cost of the forms for an ordinary building would not exceed \$800 to \$1,000, and this can be distributed over a number of buildings, making the cost for one a very small item of expense.

For a six-inch wall the core forms are set to make a web an inch and a half or two inches thick between the outside and inside walls. For a twelve-inch wall two rows of core forms may be used, making three instead of two walls. Water may be poured into the voids in the wall as it is built to prevent the concrete drying too quickly. When the wall is finished holes may be bored into the outside wall at the top and bottom of each void giving a circulation of air,

which will keep the wall dry and cool. By constructing the wall with voids a saving of about 45 per cent in the amount of concrete required for a solid wall is effected without materially impairing the strength of the wall.

Mr. Cresmer is confident that he can construct concrete walls for an ordinary house with his system as cheaply as they can be constructed of wood, chiefly because of the economy in labor and material that it will accomplish. He already has a contract to build a residence for J. C. Odell on New Magnolia Avenue and he is negotiating for the construction of several other buildings, using his new system. Mr. Cresmer expects to further develop his ideas for concrete construction as they are applied in practical building operations. Application of the system to larger structures has been under consideration but his attention is now being given to developing it for smaller buildings.

Farmer Is Biggest User of Motor Trucks

The biggest users of motor trucks in the world are the American farmers, with 79,789 motor trucks in operation.

Manufacturers come second with 75,928, and retailers third with 74,486.

These figures are taken from reliable statistics for the year 1917. Estimates for 1918 show a tremendous increase in the number of motor trucks in use; but with the farmer still in the lead.

It is estimated that during 1918 approximately 350,000,000 tons of farm products were hauled to market in motor trucks by the farmers and gardeners of the United States.

The actual operating figures averaged for the United States show that motor truck transportation is twice as cheap as horse-drawn transportation.

The motor truck handles life's necessities.

"Legislation which hits motor trucks at the very source of the life supply of the people," says R. E. Fulton, Vice-President of the International Motor Company, manufacturer of Mack trucks. "To unwisely legislate against the motor truck is to take food away from those who need it and to increase its cost.

"The motor truck is the people's friend and servant, legislation aimed to injure and handicap motor truck transportation is a blow against the best interests of the people—both producers and consumers.

"Much of this 350,000,000 tons of food products hauled from the farm to the city by motor trucks was of a perishable nature, and hundreds of thousands of tons of it would have been lost but for the rapid transportation possible with the motor truck.

"Legislation aimed to hit motor truck transportation is the result of a narrow-minded attitude of some who would hold mistaken notions that the motor truck hurts certain interests. The motor truck serves the needs of the people. It is for the people, both producers and consumers, to see that the motor truck is given a square deal and not discriminated against.

"Discrimination against motor trucks is discrimination against the source of livelihood of the people."

Breaking Up Concrete Pavements in Cities

In the city of Warren, Pennsylvania, recently, contractors were tearing down an old suspension bridge built in 1873 to replace it with a modern concrete bridge.

Stone abutments ten feet thick, fifty feet long and twelve feet high anchored the ends of the cables, and a

concrete pavement, twelve inches thick, 8,700 square feet in area, formed the approach to the bridge.

Breaking up this masonry and concrete construction was a problem. The contractors hesitated to use dynamite because the bridge was in the heart of the city, houses located within fifty feet and pedestrians and vehicles passing continually.

Ordinarily on a job of this kind, large charges of dynamite are used to break up large sections of the material every shot, but in this case, in view of the conditions, the blaster adopted what is known as a nibbling method; that is, bore holes were put down in the concrete or cement between the stones which were loaded with small charges consisting of quarter pound loads of forty per cent dynamite well tamped into each hole.

Each charge broke out chunks six to eight feet long and of varying widths. Not the slightest damage was done to adjacent buildings. Not a window was broken. No pedestrian was even startled.

In this way the work was done much more quickly than would have been possible had laborers with sledge hammers and drills been used. Thus labor cost was saved. Only thirty pounds of dynamite was necessary to complete the entire job.

Handy Rule for Balata Belts

By R. M. Williams

In looking through a catalogue published by a prominent manufacturer of balata belts, I found a table that gives the horse power of various plies of belt from three to 10, inclusive, and for speeds ranging from 500 to 4,000 feet per minute. I wondered why the information couldn't be given in the form of a rule rather than as a table, so I "doped around" and formulated the following rule which gives precisely the same values as the table, but its range is broader.

Subtract one from the number of plies, multiply by the number of revolutions of pulley per minute, then by the diameter of the pulley in inches, and then by .000158. The result is the number of horse power that a belt one inch wide will transmit. We will call this "Result No. 1."

To find the width of balata belt needed to transmit a given horse power, divide the horse power by "Result No. 1."

Where you have a given pulley and want to determine the number of plies of balata belt to buy to transmit the power this is the way to proceed:

Multiply the width of the belt in inches by .000158, then by the number of revolutions per minute made by the pulley, then by the diameter of the pulley in inches and divide the result into the horse power to be transmitted. To this one add one. The final figure is the number of plies.

For example, you have a pulley that is 10 inches wide and 30 inches in diameter. You want to transmit 50-h. p. at 400 r. p. m. How many plies of balata belt are needed?

Inasmuch as a belt should never be as wide as the pulleys on which it runs we will figure that this belt may be nine inches wide. That will leave a margin of one-half inch on each side of the pulley. We now proceed as follows, inserting values in the above rule:

$$9 \times .000158 = .001422$$

$$.001422 \times 400 = 0.5688$$

$$0.5688 \times 30 = 17.07$$

$$50 \div 17.07 = 2.93$$

$$2.93 + 1 = 3.93$$

Therefore a four-ply balata belt will do the trick. These rules apply equally to 3, 4, 5, 6, 7, 8, 9 and 10-ply balata belts.

The Missouri Portland Cement Company, St. Louis, Mo.

By M. C. Turpin

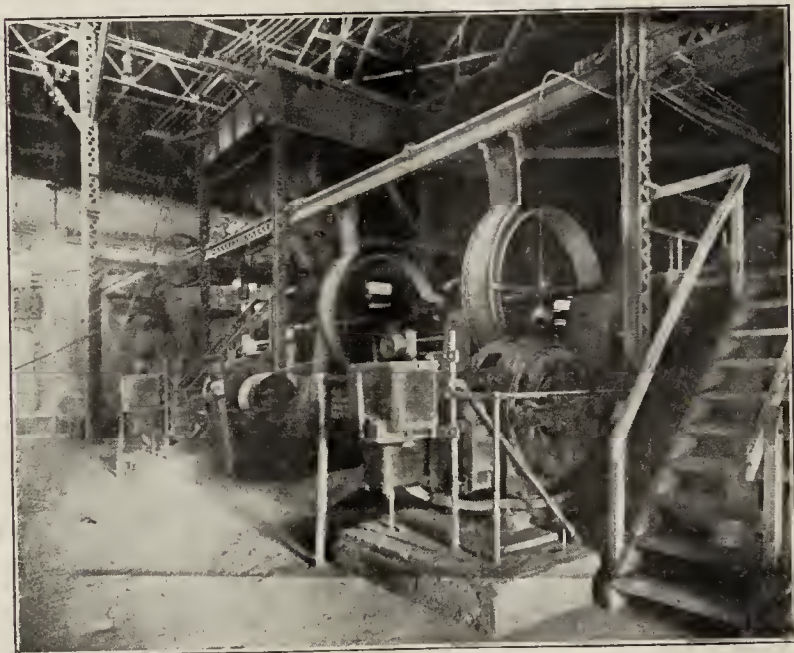
A most interesting example of the successful substitution of alternating current motor drive with power from a central station for part steam engine and part direct-current drive supplied by a private plant is to be found at the Missouri Portland Cement Company on Prospect Hill, St. Louis, Mo.

A particularly striking feature of this installation is the fact that the change over to alternating current central station drive was made without a shut down or otherwise interfering with production.

The plant makes Portland cement from rock and shale obtained locally and turns out on an average of 115,000 barrels of cement a month, having on the payroll about 300 employees.

Previous to the introduction of the present motor drive, about one-half of the mill was operated from a line shaft driven by a steam engine and the other half driven from direct current motors supplied from a generator in the plant.

Now each machine is operated by its individual motor of 150 or 200 horsepower capacity, as shown in the accompanying illustrations. Each motor on the tube or finishing mills has an auto-starter and an ammeter mounted above it, so the operator may determine the load carried by the motor.



Two 150-H.P., 440-Volt Westinghouse Type CS Motors Driving No. 16 Tube Mills installed—Missouri Portland Cement Company, St. Louis, Mo. Auto Stater and Ammeter of Westinghouse Make Are Also Shown

An important advantage derived from electric operation in this plant is that in case it is necessary for any reason to shut down a tube mill or other machine, this unit is the only one out of commission, whereas with the former method of drive, a shut down of one machine would have necessitated the stopping of some ten or twelve other mills also.

The capacity of motors installed throughout the mill on tube finishing mills and other machines totals 4,600 horsepower. The average demand, however, on the electric system is only about 3,300 horsepower and the maximum demand about 3,600 horsepower.

Current is obtained from the Keokuk Power development on the Mississippi River through the Union Electric Company of St. Louis. This source of power has proved to be very reliable. To the present time there has not been an interruption in the power supply for several months, and the last one which occurred in October, 1918, was only for a duration of five minutes. The plant runs continuously, three hundred and sixty-

five days a year, and any interruption is a serious matter because it delays production.

The Keokuk Power is brought into a substation at 13,200 volts and stepped down by means of three 1,500 transformers to 440 volts at which pressure it is



Two Westinghouse Type E-1 Oil Circuit Breakers of 300 Amperes, 1,500 Volts.

distributed through the mill for application to the motors.

The distribution is controlled through an eighteen panel Westinghouse switchboard with the necessary switches and instruments. The incoming lines are controlled through two high tension panels and two



Seven 150-H.P., 440-Volt 165-R.P.M. Westinghouse Type CS Motors Driving Tube Mills for Grinding Cement and Raw Materials. Missouri Portland Cement Company, Interior of Substation Showing 18 Westinghouse Panel Boards

E-1 3,000-ampere, 15,000-volt oil circuit-breakers, masonry mounted and remote controlled. Indicating ammeters, overload relays, graphic and integrating wattmeters, and swinging brackets all of Westinghouse manufacture, are a part of the equipment.

In spite of the thick cloud of dust always present from the cement, the electric motors which are equipped with dust proof bearings, operate most satisfactorily and have served to greatly increase the production of cement.

The company is an independent concern and has the following officers: H. L. Block, St. Louis, president; H. P. Johnson, Memphis, 1st vice-president; R. S. Colnon, St. Louis, 2nd vice-president; C. A. ———, St. Louis, 3rd vice-president; C. G. Besch, secretary-treasurer; D. N. Armstrong, general manager. All of the officers except Vice-President Johnson of Memphis, are from St. Louis, with executive offices in the International Life Building of that city.

Relation of Lime to the Use of Fertilizers

(Synopsis and address presented by Elmer O. Fippin, professor of soil technology, before conference of fertilizer sales managers, Northern and Eastern divisions, at Cornell University, June 9-13, 1919.)

Lime used in the broad agronomic sense to include both caustic and carbonate forms is one of the materials fundamentally necessary to create that condition in many soils under which commercial fertilizers are able to give their largest effect. The reasons why lime exercises such an underlying influence on the effect of fertilizers are:

First, it neutralizes active acids in the soil and thereby changes the chemical balance in a direction favorable to most of the crops that the agriculturally important, and especially for the clovers and alfalfa, and to a less extent for most of the grain, grass and vegetable crops. Similarly, this correction of acidity exercises a most significant beneficial influence on the microscopic plants in the soil that are concerned with fertility. Among these are the organisms that promote the decay of organic matter and the formation of that most valuable form commonly known as humus.

Second, it promotes the activity of those organisms that change ammonia into nitric acid which is the form of nitrogen most acceptable to the crops commonly grown on well drained soils. In the third place it is necessary for the best growth of those organisms that have the power to fix the free nitrogen in the air in combinations that are suitable for plants. This includes both those organisms that live on the roots of legumes and those that live independent in the soil on the vegetable matter. This effect of lime materials to correct acidity with the beneficial results that follow such correction, is perhaps the outstanding reason for the use of lime on soils, but it is by no means the only effect.

2. There are instances where it seems evident that the use of lime materials supplies calcium or both calcium and magnesium to the plant for food purposes. This is especially true with plants of the clover-alfalfa type that use a large quantity of lime. In addition to this direct food function, lime maintains a condition in the soil that tends to increase the availability of the plant nutrients already present.

3. The presence of a reasonable amount of lime improves the general sanitary condition of the soil by preventing the development or changing the charac-

ter of many constituents that may depress crop yields. It also prevents certain plant diseases that thrive under acid soil conditions. Best known among these is the club root of the cabbage and related plants, the common remedy for which is an application of lime to the soil.

Illustrations of the Effects of Lime

An examination of the experimental data in the northeastern states reveals the fact that very generally the presence of lime has increased the efficiency of both commercial fertilizers and stable manure over their effect without the use of lime.

At the Cornell Experiment in New York in the study of the efficiency of different forms of lime, including both caustic and carbonate forms on the succession of nine non-legume crops, lime has produced an increase in yield on heavily fertilized land ranging from a few per cent up to twenty-seven per cent. From other data where clover or alfalfa is included in the succession, the increase in the use of lime ranges from 50 per cent up to 300 per cent or more. A summary of tests throughout the southern section of the state involving the use of lime with acid phosphate and manure reveals an increase of about 1,500 pounds of hay from the use of lime alone and 480 pounds of hay from the use of acid phosphate alone. The combination of lime with acid phosphate has produced an increase of 2,400 pounds of hay per year.

At the Ohio Experiment Station, the following results have been secured in increased money return from the use of 2,000 pounds of caustic lime.

Effect of Lime and Fertilizers on Crop Yields, and Net Returns at The Ohio Agricultural Experiment Station Average of 13 Years.

Plot No.	Treatment	Corn		Oats		Clover hay, lbs.	Total value of increase.	Cost Treatment excluding manure.	Net gain or loss per acre.
		Grain, bu.	Stover, bu.	Grain, bu.	Stover, bu.				
15	1780 lbs. limestone	5.26	121	0.32	28	588	\$4.76	2.70	2.06
14	1000 lbs. caustic lime	7.74	461	2.63	218	771	7.88	3.00	4.88
6	1780 lbs. limestone manure	20.26	724	6.24	426	1156	16.11	2.70	13.4
26	1000 lbs. caustic lime manure	19.48	728	5.72	329	1105	15.30	3.00	12.35
17	26 manure* 8 tons, since 1909	17.34	816	3.58	202	715	12.00	...	....
1000 lbs.	17 caustic lime	20.13	829	5.40	202	1264	16.17	6.60	9.57
320 lbs.	Acid phosphate								
40 lbs.	Muriate of potash								
320 lbs.	21 acid phosphate	14.78	611	3.14	176	413	9.60	3.60	6.00
40 lbs.	Muriate of potash								
320 lbs.	20 acid phosphate	8.55	315	1.19	37	271	5.37	2.60	2.77

*Previous to 1909 a complete fertilizer was used.

One significant point in this Ohio data is the comparative effect of lime where different carriers of nitrogen are used. Where the carrier is sulfate of ammonia, an acid residue is left in the soil. Lime has had its largest effect, producing a total increase in value of \$11.80 per rotation as compared with \$4.51 per rotation where nitrate of soda has been the carrier of nitrogen.

On the Scottsburg field in southern Indiana on gray silt lime soil, the investigations indicate that both phosphoric acid and lime are needed and by far the

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The City of Goodrich—AKRON, OHIO



largest returns are secured where the lime is combined with the phosphorus.

In Illinois a summary of the investigations on three fields in the middle and northern parts of the state on the better soils shows an increase of 121.24 due to the addition of lime to a complete fertilizer, or an average of \$1.77 per year throughout the entire period of twelve years. On the gray silt loam of the southern part of the state, the addition of a lime to a fertilizer of raw rock phosphate and potash over a period of fourteen years has produced a total increase of \$79.84 or \$5.70 per year.

Data of similar tenor have been secured at both the experiment stations of Kentucky and Tennessee.

At the Rhode Island Experiment Station, the use of burned lime in connection with nine different carriers of phosphorus over a period of nineteen years and with a variety of crops, has produced an increase of \$22.30 per acre due to the lime. Where double super-phosphate was used, the total increase was \$149.70.

At the West Virginia Station, over a period of fifteen years, in which four crops of legumes, eight of grain, two of timothy and one of potatoes have appeared, the use of lime in the caustic form when added to a complete fertilizer of nitrogen, phosphoric acid and potash, has produced an increase of 6,265 pounds of crop over the same plant-food elements used alone. It is interesting to observe that at this same station the use of the same quantity of lime with manure has produced an increase in the same period of 17,210 pounds of crop over the yield with manure alone. This result is not unusual but commonly occurs where the soil is seriously acid. In connection with the last clover crop in the series, the use of lime with a complete fertilizer has produced an increase in yield in one year of 2,680 pounds of hay as compared with the use of a complete fertilizer alone.

The cumulative effect from the use of lime was shown by data covering a period of thirteen years at the Ohio Station, in which rotation is corn, oats and clover. The use of both carbonate forms and caustic forms of lime with and without commercial fertilizer or manure has produced consistent increases in the crops throughout the period. The effect from the caustic forms of lime has been at least as good as those in the carbonate form in equivalent quantity. Dividing the thirteen years in nearly two equal periods, it is found that the yield of all of the crops is substantially larger in the second half of this period than in the first half, and the increase in the second period is particularly marked where lime material is used with commercial fertilizer or manure.

Bearing upon the Fineness of Limestone

Data collected at the Pennsylvania and New Jersey Stations show a wide difference in favor of the finer materials. This fact has been brought out by the figures in the following table:

	8 mesh	20 mesh	60 mesh	100 mesh
Solubility in carbonated water.....	28	45	57	100
Value in correcting acidity.....	18	27	57	100
Value in the formation of nitrates....	12	56	94	100
Value in the growth of plants.....	5	22	69	100

In the above table the availability of one hundred mesh material is taken as one hundred. From this it appears that when measured by the efficiency in producing the growth of crops material of one-eighth-inch particle is only five per cent as efficient as material having particles of one-one-hundredth of an inch in diameter. Bearing on the extent of the need of

lime, it was pointed out that in New York State at least 75 per cent of the agricultural land requires the use of some form of lime as an essential factor in the maintenance or up-building of its productiveness, and that the use of lime in some quantity is desirable on at least 90 per cent of the cultivated area. The need for lime is nearly, if not quite, as great in any of the states east of the Mississippi, and from data already presented by the agricultural experiment stations it is apparent that a similar need for lime extends west of the Mississippi at least as far as the eastern sections of the states of Kansas and Nebraska. Wherever the rainfall is high in the districts west of that section, lime is also likely to be required by the soil in good farm practice. Lime with humus may be looked upon by the farmer and the fertilizer industry as the frame to a picture. The increases in yield that are possible from the use of fertilizer is the picture but this picture does not show off to good advantage until it is framed by the proper application of lime and the presence of a reasonable quantity of humus in the soil. Since the use of lime is often necessary for the growth of those crops by means of which humus is best maintained, lime thereby becomes the foundation of this frame for the fertilizer picture.

It is up to the fertilizer trade to see that their fertilizer picture is properly framed in the hands of the farmer by the wide use of lime and the maintenance of humus in the soil. The keynote in the fertilizer trade, as in all other lines of commercial activity, is service as measured by the returns that may be secured by the consumer. There should be the most cordial co-operation between those persons concerned with the use of fertilizers and those interested in lime materials, and both of these with all agencies concerned with agricultural practice.

Taylor Engineering & Mfg. Co.

Traylor Engineering & Mfg. Co., Allentown, Pa., designer, builder and erector of stone crushing, ore dressing and smelting plants, has just issued Bulletin JX-I, which gives a comprehensive description of a number of its products, notably the Bulldog jaw crusher. In developing this crusher the company's engineers started in to design one that would have a stronger and more reliable main frame than could be made of either cast steel or cast semi-steel. After months of work, what was considered the perfect jaw crusher frame was designed and not only was the frame perfected, but other essential parts of the crusher, such as the pitman, toggles, oiling system, etc., were brought to a state that was not thought possible when the engineers commenced their experiments. Previously, the company says, all crushers of this type had followed the lines laid down by Blake, the designer of one of the earliest stone breakers, making use of the toggle system for crushing the stone or ore, and no real improvements over the original Blake design which would tend to lower the cost of operation and maintenance had been made. With the Bulldog jaw crusher perfected, the company makes the claim that it will require less power per ton of rock or ore crushed, will need less attention and can be maintained for less money—70 to 80% of the friction load developed by the Blake type crushers being eliminated—than any other crusher. The bulletin also describes the Traylor revolving stone screen, Traylor Sheridan shaking grizzly, Traylor friction hoists, heavy duty crushing rolls, and Bulldog gyratory crushers.

Ohio Hydrate & Supply Co.'s Plant

Ranks High Among Modern Institutions Whose Cardinal Principles Are a Superior Product, Maximum Capacity and Minimum Operating Cost

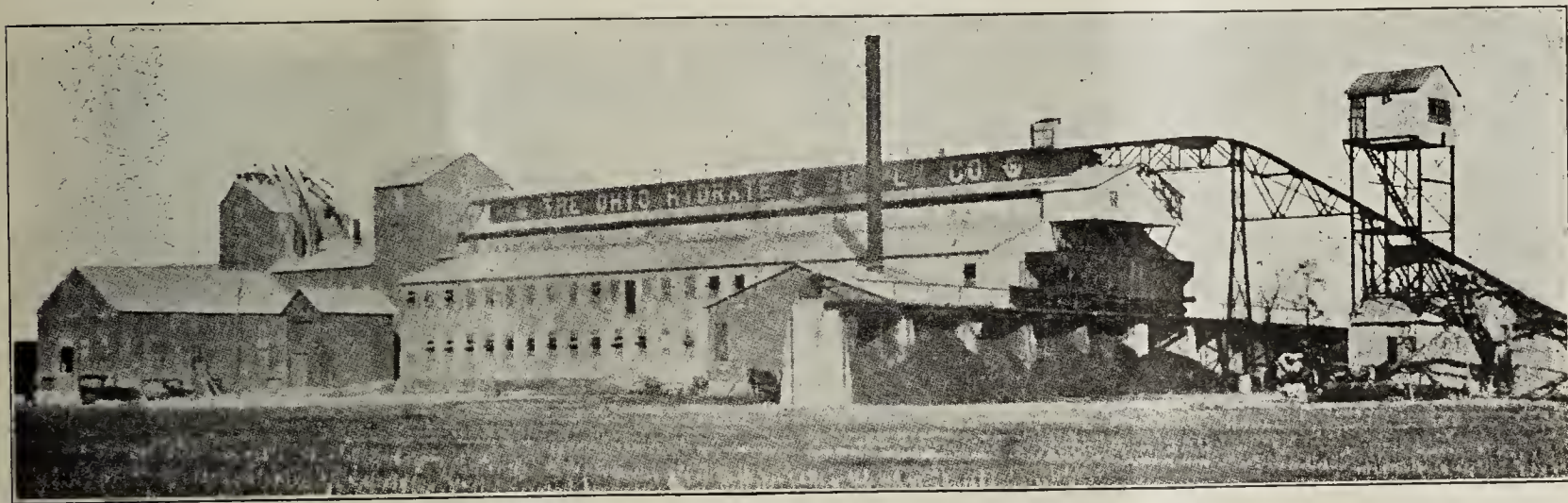
The lime plant of the Ohio Hydrate & Supply Company at Woodville, Ohio, is designed throughout so as to be practically automatic. So precise is the adjustment of one machine to another that less than twenty men (not counting the quarry force), are required to produce 300 tons of high-quality hydrated lime daily from its twelve kilns and automatically controlled hydrator.

In these days of labor shortage and high wages it doesn't need a wizard to figure out that President and General Manager W. H. Price has, in having had designed and erected for his company a plant which keeps the quality of his product at a maximum with a minimum cost of production, placed the Ohio Hydrate & Supply Co. in a strong strategic position in the battle of commerce.

The stone crops out on the surface over most of the property so that there is practically no stripping to do. One "Clipper" well drill is sufficient to put down the blast holes which are now drilled to a depth of

ery track which runs along the end of the plant. From these piles it goes by conveyor to a crusher and is elevated to the kilns by an automatic arrangement which absolutely eliminates labor other than that necessary to handle the coal from the storage piles. The kiln firemen can obtain any amount of coal at any time without greater inconvenience on their part than the pulling of a lever. Even this is to be eliminated in the near future by the installation of automatic stokers.

The kiln coolers are opened with a special type of draw shear easily operated, and which does away with the necessity of a man subjecting himself to great heat in discharging the calcined stone from the coolers to the cooling floor. The line is automatically carried to the crusher with only the assistance of a storter who tosses aside the remarkably small proportion of cores. After passing through the crusher the quick lime goes by elevator to a special type of bunker which eliminates clogging.



Ohio Hydrate & Supply Company's New Mill

about 30 feet. Powder is used for blasting, from the ledge. Air drills and dynamite are used in pop blasting.

A special type of steel, gable-bottomed car is used to deliver the stone from the quarry to the kilns. At present these are not loaded by hand as the excavation is not yet large enough to accommodate a steam shovel. The loaders work in pairs and the cars by reason of their special low construction are easily and rapidly filled, keeping the cost of this part of the work remarkably low.

These cars are hoisted over the tops of the vertical kilns and dumped automatically. Instead of the hoisting man being on the top of the kilns, subjected to the inconvenience and deleterious effects of the smoke and escaping gases, he is located in a tower erected about midway between the edge of the pit and the end of the row of kilns. This tower is on a level with the top of the kilns and gives the operator a perfect view of both pit and kiln tops. The trippers as well as all of the hoisting apparatus is controlled by this one man in the tower. A car can be dumped in any kiln at will, not necessarily in a given rotation.

The kilns themselves are a special type cylindrical steep jacket with a special method of interior construction and lining and a system of heat control which insures uniform burning. The coal is delivered from hopper bottom cars to storage piles beneath the deliv-

Poidometer and Hydrator

From the bunker it is delivered through a poidometer to the Schaffer hydrator. In connection with poidometer and hydrator is an automatic elevator control. The quick lime is delivered from the storage bunker to a small hopper superimposed upon the poidometer. It would necessarily follow that this hopper would not always of its own accord be fed regularly. Therefore, it is so arranged that when the hopper is full, the elevator which delivers the ground quick lime from the storage bunker to the poidometer is automatically stopped. When the material in the poidometer hopper has found a certain level, this feeding elevator is again automatically started. Not only does this apply to the elevator but to other apparatus behind the elevator. The hydrator together with the poidometer delivers the quick lime in a constant and even flow at so many pounds per minute and adds the water automatically. The hydrator construction is remarkable in strength, rigidity and adaptability to all conditions. There are things which only a highly technical man will appreciate and understand, among them temperature and pressure gauges which have a deep significance in meeting certain conditions which occur in the process of hydration. From the hydrator the lime is taken by screw conveyor to two Raymond No. 2 pulverizers and a No. 11 spiral air separating system, all being direct connected, which blows the finely

ground lime to two hydrate storage bins holding 150 tons. The tailings or rejections are not discarded as in many plants but are used as a by-product which is proving of considerable value, the salvage being accomplished automatically.

From the hydrate storage bunkers the lime is fed into two four-tube valve-bagging machines. A two-tube machine is used for the tailings. President Price has evolved a practical system of checking the bag weights. It is recognized that if the operator of a bagging machine becomes careless in the adjustment of the automatic weighing device there is likely to be a divergence in weights. This sometimes results in complaints of purchasers who insist they have not been given true weight and quite frequently these claims are exaggerated. To have an absolute check upon the weights the operators of the machines are required to take hourly check weights on a portable scale from each tube of the bagging machines. These are recorded on a blank provided for the purpose and these records kept on file. Should a complaint of wrong weight come from a purchaser the check weight sheets are at hand as evidence that the weight was correct when the bags left the plant.

Special Tests Made

Since the plant has been in operation and the product on the market the company has learned as the result of government tests and also the reports of users that the hydrate produced has an unusually quick initial set coupled with a slow final set. Through exhaustive tests Mr. Price and the designing engineers have ascertained that chemical reactions occur in the hydration of lime which have heretofore not been considered. The equipment and process of hydration was designed to meet these conditions and as a result an unusually high quality of hydrate is being produced. It was to produce a hydrate of this character, a hydrate that would meet the demand for a high quality product at a minimum cost of production, that the plant was originally designed but in addition has been achieved a beautifully working example of what can be done in the way of proper co-ordination of machinery and units and also of great flexibility in manufacture, thus preventing delays and shut-downs.

All power transmission is accomplished by direct connecting motor drive and all construction is steel and concrete, fireproof throughout.

The plant was designed and the equipment selected by the Schaffer Engineering & Equipment Company of Pittsburgh.

Concrete Manure Pits

The most valuable parts of manure, as fertilizer, are the soluble parts. Manure stored in the old way under the barn or in the barnyard is exposed to the action of the rain which dissolves these salts and carries them into the ground where they are wasted.

The concrete manure pit preserves the manure at its full strength and this saving soon pays for the cost of the pit. A concrete pit may be easily roofed over and this will largely eliminate the nuisance of flies, whose chief breeding place is in manure piles.

With Sump

In Figure 1 is shown a pit with a corrugated slope at one end so that the manure spreader or farm wagon can be backed directly into the pit for ease in loading. At one corner is a sump 2 feet 6 inches square by 18

inches deep which catches the liquid manure. The floor is given a slope of $\frac{1}{4}$ of an inch to a foot toward the sump. This pit is 16 feet by 31 feet and 3 feet deep. The walls and floor are 6 inches thick and the floor is reinforced with $\frac{1}{4}$ inch round rods, spaced 12 inches apart each way, in the center of the slab. The

Fig. 1. Reinforced concrete manure pit with sump. Such a structure preserves all of the fertilizer elements.

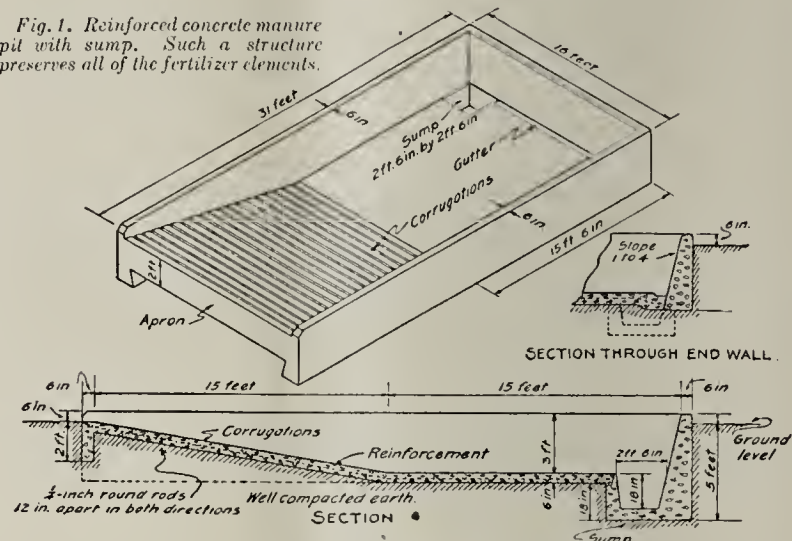
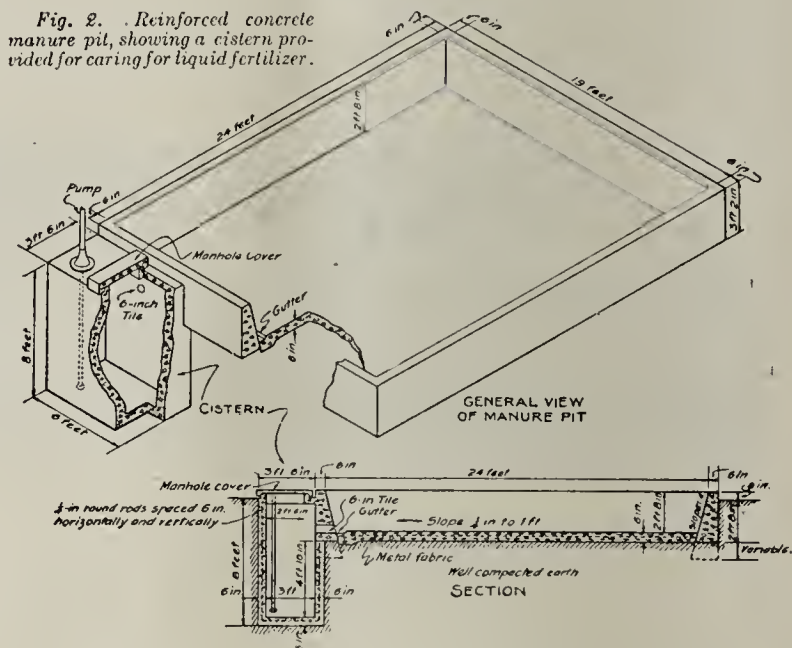


Fig. 2. Reinforced concrete manure pit, showing a cistern provided for caring for liquid fertilizer.



With Cistern

concrete should be mixed in the proportions of one part of cement, $2\frac{1}{2}$ parts of sand and 4 parts of crushed stone or gravel. This will require 114 bags of cement, $10\frac{3}{4}$ cubic yards of sand and 17 cubic yards of crushed stone or gravel.

In Figure 2 is shown a type of pit which does not allow loading by backing into the pit. This type of pit should be built with the walls about two-thirds out of the ground to make loading easier. A cistern 5 feet by 5 feet by 3 feet is provided for the storage of liquid manure.

This pit is 20 feet by 25 feet with walls 3 feet 2 inches deep, making the depth of the pit 2 feet 8 inches. The floor is 6 inches thick and is reinforced with wire mesh fabric. The mixture should be of 1 part of cement, $2\frac{1}{2}$ parts of sand and 4 parts of crushed stone or gravel. This will require 123 bags of cement, $11\frac{1}{2}$ cubic yards of sand and $18\frac{1}{4}$ cubic yards of crushed stone or gravel. The reinforcing required is 800 feet of $\frac{1}{4}$ -inch round rods, which will weigh 134 pounds, and 372 square feet of wire mesh fabric which will weigh 186 pounds.

Oshkosh Manufacturing Company Announces Completion of New Service Plan

A news item which will probably be of more than usual interest to the building industry, is the announcement by the Oshkosh Manufacturing Co., Oshkosh, Wis., of the company's new service plan. The company has just completed the establishment of a chain of service stations throughout the United States for the benefit of its patrons. These service stations carry a complete line of repair parts for all Oshkosh machines and maintain fully equipped shops for either repairing or completely rebuilding Oshkosh machinery. An engine and machinery expert is in charge of each repair shop.

Besides these fully equipped service stations a large number of sub-stations have been established. Not all of the sub-stations carry a complete line of parts or maintain repair shops, but if they do not they can get this service within a very short time. It is the claim of the Oshkosh Manufacturing Co. that now it does not make any difference where an owner of Oshkosh equipment may be located they are prepared to render immediate service, over night at the longest.



J. W. Wooley

J. W. Wooley, general sales manager of the Oshkosh Manufacturing Co., in making this announcement, said: "It has always been our ambition to perfect this service idea. We have felt that service is the one big thing needed in the contracting business. We know that now no matter how well machinery is built, and we build ours as well as forty years' experience could teach us, there are times when repairs are needed badly. A discharge chute wears out or a sprocket wheel is broken in an accident. Right then the most important thing in the world to that contractor is the needed repair. If he can get it at once everything is lovely, but if he has to wait three weeks till it arrives from the factory he generally gets pretty much disgruntled with the firm that sold him a mixer and then forgot him.

"With our new service system the owner of an Oshkosh machine can get service right when he needs it.

All he has to do is telephone his dealer. The needed repair will be there in a few hours, twenty-four at the very longest, and the wheels are turning again. If he happens to need an expert engine man there is one available.

"We believe that such service is bound to mean satisfied customers and we feel that this is about the most important step we have ever taken."

This service seems to be rather an innovation in the contracting field and should prove highly advantageous to owners of Oshkosh equipment.

Hydrated Lime in Concrete Roads

The sub-committee on Highway Lime of Committee C-7 of the Lime Manufacturers Association, Washington, D. C., has begun active work toward the development of complete information about lime in hard surfaced roads.

Through the Lime Association, 20 tons of hydrated lime has been donated to the Maryland State Roads Commission for actual field tests on two concrete road contracts, one at Bellaire, Md., and one at Muirkirk, Md. The interesting point about these two contracts is that central mixing plants are being used. This is something new in concrete road construction and the method is receiving a great deal of attention on the part of the highway engineering profession. If the system works satisfactorily, on account of the economies in construction which it presents, it is destined to become the most used method in concrete road construction.

In this system the concrete is mixed at a central point and then hauled in trucks to the work. The distance of hauling on the two contracts in question is as far as seven miles and it is needless to say that segregation occurs during the hauling and it is a hard matter to remove the concrete from the trucks.

The sub-committee's program has been carefully planned and lime has been ordered on the jobs and the test will go forward immediately.

A Huge "Bulldog" Stone Crusher

The Taylor Engineering & Manufacturing Company of Allentown, Pa., recently built for the Michigan Limestone & Chemical Company a 60-inch Traylor "Bulldog" gyratory crusher, which is described as being "the largest stone crusher in the world." This giant machine has two receiving openings, each 60 inches by 190 inches, and its capacity is 2,500 tons of crushed stone per hour. A folder says that the first gyratory crusher was built about 40 years ago with two receiving openings each 7x28 inches and a capacity of 10 tons per hour, and that the two men who have had more to do with the development of it than any others are Richard Bernhard and L. J. Hewes, the former chief engineer and the latter Chicago district manager for the company.

New Publication

"We Welcome Fair Competition" is the title of a circular just issued by the Portable Machinery Co., Passaic, N. J., manufacturers of the Scoop Conveyor. It briefly describes how one concern has copied and is trying to market an imitation of the Scoop Conveyor. As there is suit now pending for infringement of rights, the circular warns possible customers of portable conveyors against purchasing the imitation.

Interesting Features of Dewey Cement Plant

Circular Concrete Bins Used for Storage with Capacity of 60,000 Barrels—Plant for Recovery of Gasoline from Casing Head Gas. Commercial Crushed Stone Also Produced

By A. L. Frank

One of the cement plants that has, perhaps, the most satisfactory record as a manufacturing concern, is that of the Dewey Portland Cement Company plant at Dewey, Okla., in the Central West, offices in Kansas City. In its entire history it has been under the active management of the same men that promoted it and put their own money in it. In the eleven years since the first car of Dewey was shipped, an extraordinary dividend record for a Western manufacturer has been made.

Commercial Crushed Stone

But this is not intended as an eulogy on financial management of the Dewey Company. There are some details in connection with the plant that should prove interesting to readers of CEMENT & ENGINEERING

dition to this, there are four rectangular sacking bins built across one end of the house, the outlet discharges of which are maintained at an elevation of twenty feet above the sacking room floor.

The sacking room and train shed inclose three shipping tracks and contain equipment and spouting for eight sacking machines to be worked simultaneously.

The storage has a capacity of 60,000 barrels. The cement coming from the mill is received at the storage by means of screw conveyors, which deliver it to a bucket elevator, located on one of the outside contents by means of screw conveyors to all of the storage bins.

Under each row of bins is a reinforced concrete tunnel built in the foundation $6\frac{1}{2}$ feet by 6 feet wide,



The Dewey Portland Cement Company's Plant

NEWS. One of these details concerns the production of commercial crushed stone of binder and concrete size, an unusual feature in Western cement mills. Special screens were installed to which rock destined for crushed stone rather than cement production is diverted. These screens assort the rock into three sizes. $\frac{1}{2}$ inch to $1\frac{1}{2}$; $1\frac{1}{2}$ to $2\frac{1}{2}$; $\frac{1}{2}$ to $2\frac{1}{2}$. Storage facilities have been installed for 1,200 yards of the screened rock; 400 tons per day is the average productive capacity; and three loading tracks are situated beside the storage bins.

Another feature, one that attracted national attention at the time of construction, is the storage for cement, erected by the Macdonald Engineering Company of Chicago. At the time this storage was built concrete elevators were not the most commonplace structures on earth. Predictions of failure were freely made; it is sufficient to say that these predictions never materialized. The vertical bin readily lends itself to the handling of material, both into and out of the bin, by machinery.

Bin Construction

This structure, occupying an area of 75x164 feet, consists of four vertical cylinders 32 feet inside diameter and 80 feet deep, with one central interspace and two end pocket bins, each forming separate compartments for the storage of cement, and is the highest storage of this character in the United States. In ad-

which contains the screw conveyor for carrying the cement from the storage bins to the elevator leg for delivery into the sacking compartments.

Solid Foundation

The building was erected on a foundation consisting of a continuous footing slab of heavy reinforced concrete, 4 feet thick. This slab extends beyond the outline of the bins 4 feet, in order to distribute the extra load, due to the arching action of the cement and its friction on the side walls.

The bottoms of the storage bins rest immediately on the foundation slab and as the cement stands at a very flat angle of repose, the conveyors will not quite empty the bins at any time by gravity, but as it is rarely necessary to completely empty the bins, the bottoms are left flat.

The walls of the storage bins are 10 inches thick and are reinforced from the bottom to the top by means of $\frac{3}{4}$ -inch round rods placed horizontally in the concrete during construction. The amount of steel used for this purpose is about twice as much as would be ordinarily required for a grain bin storage of similar design. The vertical reinforcing of $\frac{3}{4}$ -inch round rods is spaced about 2 feet centers in the bin walls.

The raw materials used in cement making are limestone of Pennsylvania age and a Quarternary clay, most of which comes from the quarry as overburden.

The quarry is one and one-quarter miles southeast of the plant. Drilling is done by steam drill mounted on a wagon. The head swings on a radius of five feet through 180 degrees, allowing two or more holes to be drilled at one set up. The drill rod which rotates receives 250 blows per minute. The hole is cleaned by a $\frac{1}{4}$ -inch stream of water delivered under high pressure at the point where the drill is cutting. In this way the drill is not impeded by cuttings; 200 feet of $3\frac{1}{2}$ -inch hole per 10 hours is the capacity of the machine. So far as I know the company is the first to use a drill of this type on cement materials, and has found it superior to the tripod or churn drills formerly used.

The drill holes are loaded with dynamite and electrically fired in groups of 50.

The rock is loaded into 6-yard dump cars by steam shovels, these being a 5, a $2\frac{1}{2}$ and a 1-yard in the quarry, and hauled to the plant in 25-car trains over standard gauge, rock ballasted track by a 30-ton locomotive, two 15-ton engines being held in reserve or used in switching.

The quarry equipment also includes a complete shop of reinforced concrete construction, an air compressor furnishing air in the jack drill for drilling such rocks as are not broken by the main shot to convenient size for handling. There are reinforced concrete houses for the storage and thawing of dynamite and caps. Water is obtained from an adjacent stream across which is a concrete dam and is pumped to a reinforced concrete softening tower 60 feet high, from which it is supplied by pressure to the various machines.

Three-way Switch

On arrival at the plant the cars are placed on one of three tracks, all of which are connected by a three-way switch to the track leading to the crusher building. These tracks, which have a capacity for 60 cars, are left full at 5:30 p. m., so it is not necessary to operate the quarry more than 10 hours.

Crusher

From the storage track the cars are drawn up an incline and dumped into a No. 10 gyratory crusher which discharges into a 42-inch all-steel bucket elevator which delivers the rock into two round steel tanks 49 feet high and 22 feet in diameter. From this storage rock is fed to a hammer mill, then elevated to two 6-foot by 60-foot gas-fired dryers. Part of the stream from the hammer mill is diverted to screens which assort the rock into commercial sizes. The rock under $\frac{1}{2}$ -inch is returned to the dryer and after it is dried is passed over a screen clothed with 7 mesh wire. The material passing containing the overburden from the quarry, together with some fine rock, runs about 62 per cent carbonate and is used as clay. It goes into storage into one of a battery of three steel tanks 49 feet high and 22 feet in diameter, the other two holding dried rock direct from the Williams mill.

Tube and Roll Mills

Rock from these two tanks, together with whatever amount of 7 mesh screenings may appear necessary to the chemist, is elevated to hoppers over four kominuters, the idea to approximate the mix as closely as possible so that little or no correction may be needed later. The material from the kominuters on its way to one of a battery of five hoppers is automatically sampled. After the laboratory has made its test on the sample of a hopper it is drawn through a conveyor to a pair of scales where the proper amount of clay is added to correct its composition, or is drawn with another hopper of such composition that the average will produce the proper mixture. From this point the material is distributed to hoppers over five clypeb

tube mills and one roll mill which grinds to a fineness of 96 per cent through the 100 mesh. The material from all these mills is elevated into one conveyor to promote a uniform mixture and is discharged into hoppers of 300 barrels capacity located over the kilns, or into a concrete bin of 4,000 barrels capacity, from which it may be drawn to the kiln hoppers as needed. This extra storage permits the raw mill to be down for repairs or on Sundays without interfering with the operation of the kilns.

Coal Fired Kilns

The kilns, of which there are five 8 by 100 feet, coal fired and driven by variable speed motors, discharge into a bucket conveyor which takes the clinker to an 8 by 60 foot cooler, a smaller one being held in reserve. From the cooler the clinker is elevated to the top of the clinker storage, which is 80 by 100 feet, discharged into a hopper, thence to a car over scales. After weighing the car is pushed along the track and dumped at any desired point.

Gypsum Added

From this storage clinker is drawn by a pan conveyor in a tunnel centrally located. As the pan conveyor discharges the proper amount of gypsum is automatically added. The elevator supplies clinker to hoppers located over kominuters from which the product goes to a 3,300 barrel storage located over four tube mills. The finished product is stored in four flat bins of 11,000 barrels capacity each, or in the 80-foot circular storage. From either storage the cement is elevated to hoppers located over sacking machines of a special type developed by this company. The weighing is not done by the machine but by hand, and thereby insures the correct weight in each sack.

The loading tracks have storage for 40 empty cars and are so arranged that two cars on each system may be loaded at the same time. The loading dock is covered by a concrete roof which permits loading regardless of weather.

Conveniently located across the tracks from the sacking room is the bag house. In this building returned sacks are cleaned, sorted, patched and counted. It is of reinforced concrete and contains storage for 1,000,000 sacks.

The Coal Mill

The coal mill, which was built four years ago after gas, the original fuel, became exhausted, is of reinforced concrete trestle on which the loaded cars of coal are placed by the switch engine. Opposite one end of the coal mill is a concrete hopper into which cars are dumped. From the hopper the coal passes into an apron conveyor, thence to a disintegrator when needed, after which the coal is elevated to a storage hopper. The housing of this elevator, as are also all the main elevators throughout the entire works, is of reinforced concrete. From this hopper coal is fed by a short belt conveyor over a magnetic separator to a dryer which discharges into an elevator from which are supplied the hoppers over the three roll mills. These mills grind coal to a uniform fineness of 96 to 98 per cent through the 100 mesh sieve. The cyclones discharge into a conveyor which carries the coal to the kiln room about 200 feet distant.

Storage for ten cars of coal on the trestle and 50 cars on the track on the ground is provided.

Power Plant

Power is supplied by six 500 horsepower and one 1,425 horsepower twin tandem Bessemer gas engines direct connected to 60-cycle, 400-volt generators operated in parallel. Throughout the mill, so far as pos-

sible, each machine is driven by its own motor, there being 60 motors in all.

Complete machine, electrical and blacksmith shops and a storeroom complete the mill buildings. A 2½-story reinforced concrete building 40 by 40 feet houses the laboratory and local office. The Dewey Company looks for a big year this year and hopes to test that 4,000-barrel productive capacity repeatedly.

Gasoline Recovery

In addition to the above, a plant for the recovery of gasoline from casing head gas is operated. It consists of three 2-stage compressors, direct connected to gas engines. Each unit has a capacity of 700,000 cubic feet per day and a yield of approximately three gallons per 1,000 cubic feet of gas is obtained. A pressure of 40 pounds per square inch is maintained on the low stage and 300 pounds on the high stage. The gas under pressure is cooled in a series of cooling coils. The combined effect of pressure and cooling is to condense the gasoline into a liquid. The gravity of the condensate, which is about 90 degrees B., is so high as to preclude its use or shipment. Its gravity is lowered to 70 degrees B or less by the injection of the proper amount of naphtha into the cooling coils. The finished product is shipped in the company's own tank cars. The gas, after extraction, is used in the gas engines of the cement plant.

Big Crushed Stone Industry Is Now Operating at Ball Mountain

Among the many natural resources of North Carolina is her magnificent stone deposits. Her granite products are known throughout the country; and in the opening of the large quarry of rhyolite at Ball Mountain, near Newsome, another quality of stone is being placed on the market, which will doubtless become no less widely known and celebrated than North Carolina granite.

The quarry at Ball Mountain was opened up by the Winston-Salem Southbound Railway Company some years ago, while the road was in process of construction. Title to the property still remains in the company; but it has been leased for an indefinite period



No. 8 Crusher. Below It Is a No. 5 Crusher

by the Paul and Cornell Co. of Newsome, N. C. This company is operating the machinery at the quarry at its full capacity, and it is shipping to various parts of the state an average of 750 tons of stone per day, or about 15 car loads.

Location of Plant

The main line of the Southbound runs at the foot of the mountain containing the quarry and the machinery for manufacturing the stone is located on a siding paralleling the main line. The plant is located about the center of the quarry, which faces the main line of the Southbound and the Yadkin for some 2,000 feet. It has an operating face 1,000 feet long and some 60 feet high, and the mountain rises perhaps more than 100 feet above the quarry as now opened. There have been about 300,000 tons of stone removed from the mountain; and as yet the supply seems to have been hardly touched.

Quality of Stone

It was an exhibit from this quarry that took the blue ribbon at the North Carolina State Fair last month for being the best material for concrete and heavy road building with bituminous binding. The stone is known as rhyolite. It is a dark blue and shows a hardness of 19½, a toughness 20, a water absorption of .23 pounds per cubic foot and shows a wear of only 27 per cent.



Quarry Car Dumping Into No. 8 Crusher

The material shows absolutely no disposition to crumble or disintegrate in any way when subjected to heavy loads or traffic. It is so hard that manganese steel concaves that last a year or more in limestone or rock of ordinary hardness is cut out in this material in two weeks. The wear on other machines, elevators, buckets, et cetera, is similar.

Material Manufactured

The company manufactures material for many purposes. Sizes are put out as follows: 2½-inch to 2-inch material for foundations and base material for roads and like constructions, 1½-inch to 1-inch material for general concrete structures not so massive, ¾-inch to ¼-inch material for reinforced concrete buildings and road work, ½-inch down for top dressing for macadam roads and rock roads of all descrip-

tions. In addition to this they can also furnish a roofing gravel.

Equipment of Plant

Strictly modern equipment was installed at the quarry when it was opened up, and new machinery equally as up-to-date has been added from time to time as occasion demanded. And in this connection it is particularly disappointing to learn that the small drills usually employed for drilling block holes in boulders preparatory to blasting material to desired size for feeding crushers have proved useless here on account of the extreme hardness of this material.

The power of the plant is generated by three 100-horsepower boilers, giving steam to 150-h. p. engine, 100-h. p. air compressor and a 60-horsepower double cylinder steam hoisting engine. Along the face of the quarry runs a cable way with a $\frac{5}{8}$ -inch endless line of 2,100 feet and a hoist line of 1,100 operating over towers 1,000 feet apart and 75 feet high with a capacity for handling seven tons of material.

The crude stone is blasted from the quarry, the charges being set off with electricity. It is then blasted or broken up into smaller parts and placed in buckets along the cable way. These buckets are taken up by the cables and the material is carried to the plant and dumped into a chute which conveys it into a No. 8 gyratory crusher.

After the material is crushed in this machine it is carried by a bucket elevator up to the screens. There all material of the desired size falls into the repository and that which is too large is dumped into another chute which conveys it to a No. 5 gyratory crusher to be crushed again. After passing through this machine the material is carried back by another elevator to the screens and the process is kept up until the stone is of the desired size.

In addition, also, to the material brought to the cable way, cars bring in great quantities of it from the other side of the mountain, which was opened up in the hope of finding a softer stone. As it turned out, however, the material found there was harder than that at the original place of operations. The Crystallography of all this material is such that no two pieces break alike. The fragments and larger pieces, too, are all characterized by their sharp, knife-like edges. Concrete construction with rock is said to be almost indestructible.

Filling Contracts

The Paul and Cornell Co. is in no danger of stopping operations for lack of business as it has large contracts on hand. But it is nevertheless making others, for its material has a constantly growing demand. It has a contract with the Winston-Salem Southbound Railway for 100,000 cubic yards of ballast. It supplied the Southern Aluminum Company at Baden with great quantities of material for construction of buildings and is also filling a contract with the Forsyth Highway Commission for road building material. A contract has just been closed with the city of Graham for 5,000 tons of material for street purposes. Numerous smaller contracts are being filled and large contracts are under way in Wilmington and cities and towns of the State.

The Camp

The operations of the company are under the direct management of Mr. Chas. Paul and Mr. L. P. Tobin, who have quarters on the southern end of the mountain where there is a little village of about 25 houses, accomodating something like 150 people. The company maintains a commissary and also provides for its employes a company physician. Industry is the watchword of the little settlement. All work. The men and their families are well provided for and live well.

Gravel Concrete Unsatisfactory for Fireproofing

The report of the Committee on Fireproofing of the American Concrete Institute, Walter A. Hull, chairman, presented at the annual convention at Atlantic City, contains recommendations concerning two items of concrete construction that should be observed by builders. The items about which recommendations are made are the thickness of the protective coating outside of the steel of columns and the selection of aggregate for structural work that may be subjected to high temperatures resulting from fires. Recommendations by the committee are that the thickness of protective concrete on columns be not less than 2 or $2\frac{1}{2}$ inches, depending on circumstances, and that for fire-resistive construction, limestone, trap rock, blast furnace slag and burned clay be given a preference over highly silicious gravels.

The data on which the committee based its recommendation expressing a preference for other aggregate than gravel for concrete in fire-resistive construction was obtained from laboratory and field tests that have been accumulating for a number of years. Investigations of the fire-resistive properties of concrete made as early as 1905 resulted in a report prepared by Ira H. Woolson, director of the laboratories of the National Board of Fire Underwriters, that was adverse to the use of pure quartz gravel as aggregate. The fire-resistance qualities of gravel concrete were shown to be inferior to concrete made from other aggregates by tests made also by the Bureau of Standards.

The tests at the Bureau were made on 50 concrete columns of various sizes and shapes. The aggregate in the columns and the thickness and composition of the protective coating varied in different columns. The tests consisted in subjecting the columns to the standard 4-hour fire test and then in applying a destructive compressive load by means of a testing machine. Observations were made of the tendency of the protective coating to spall off during the test and of the amount of the load that caused failure after the fire. The committee says in its report:

In the fire tests of concrete columns made by the Bureau of Standards, gravel concrete columns were shown to be greatly inferior in fire resistance to columns having no other aggregates. While this applies to all types of columns, the contrasts were greatest in round columns, vertically and spirally reinforced and in vertically reinforced square columns. It is probable that similar results would be obtained from all gravels made up largely of highly silicious materials, such as sandstone pebbles, quartz pebbles and granite pebbles.

The susceptibility of gravel-concrete structures to damage from fire is shown by the results of fires occurring in buildings as well as by the results from the laboratory tests. The most recently investigated conflagration was one at Far Rockaway, N. Y. Investigations of this fire were made by the National Board of Fire Underwriters and by a special committee of the American Concrete Institute, of which Richard L. Humphrey was chairman. The conclusions drawn in the report of the Board of Fire Underwriters are that a large part of the damage is attributable to the pure quartz gravel aggregate.

Additional evidence was collected from investigations of two industrial-building fires that occurred in London during 1917. Although the fires were started by an explosion that did considerable damage by itself, the inability of gravel concrete to withstand the destructive stresses caused by a severe fire was reported

as a cause of part of the damage. The report of the British Fire Prevention Committee contained the following paragraphs:

It is clearly shown that Thames ballast or gravel concrete is an unsuitable material for reinforced concrete in buildings where the risk of a severe fire had to be considered.

Where a suitable aggregate or combination of materials is used in the future and the reinforcement accorded proper protection, only superficial damage need be expected, *i. e.* damage repairable without extensive reconstruction.

The Committee on Fireproofing made the following recommendations:

1. That for fire-resistive construction, limestone, trap rock, blast furnace slag and burned clay be given a preference over highly silicious gravels.

2. That in cases where gravel aggregate is to be used, with no additional protective material over the concrete, round columns be given a preference over rectangular ones.

3. That where gravel aggregate is used, all columns, but especially rectangular columns and round columns with spiral reinforcement, be given the additional protection of approximately 1 inch of Portland cement plaster either on metal lath or reinforced by light expanded metal.

Causes of Failure in Slag Concrete

Although well made concrete is a very reliable building material, there have been cases where concrete, in which slag has been used as an aggregate, has failed. The chief causes of failure were given by Dr. J. E. Stead in a paper read last June before the Cleveland Institution of Engineers as follows: (1) The scrimping of the cement, leaving the finished concrete in a very porous condition, which is not serious in constructions above water level, but where fresh or salt water has free passage into or through the concrete is almost certain to cause disintegration—rapidly by sea water and less so with fresh water. Whatever the aggregate may be, porosity in concrete is certain to lead to premature destruction by sea water. (2) To the use of the fines from old slag dumps, which often contain coal ashes and other deleterious substances. It is therefore desirable to riddle off and reject all that will pass a sieve with $\frac{1}{2}$ -in. mesh, or better, the pieces smaller than 1 in. in diameter. Preferably it is safer not to use anything but pure clean slag. Coal ashes are sometimes present in mixed dumps and contain sulphides of iron, which in pressure of air and water produce acid solutions which react on the slag, dissolving a portion of the alumina and lime, producing the aluminum-calcium sulphate, which may cause expansion. Concrete floors and pavements have been known to expand and buckle purely owing to the oxidation of the sulphides and production of hydrated calcium sulphate, and possibly due to the production of the double salt just referred to, particularly in cases where care has not been taken to remove the fine slag, and when the concrete has been porous and kept in a dump condition. It is advisable therefore not to use any fine slag at all for floors exposed to such conditions, but employ ordinary sand instead, and in confined positions, such as the floors of dwelling houses, to refrain from using slag as an aggregate owing to the property slag has of yielding sulphured hydrogen when it is moistened.

Concrete Highway Construction Standards Raised

Mississippi Valley State Road Officials Recommend Tamped Concrete and Heavier Sections—Action Affects Wide Territory

Better built subgrade, heavier slab sections, graded aggregates, slump consistency tests, tamped concrete, and more intensive finishing are recommended for concrete roads by the Mississippi Valley Association of State Highway Departments. The exponents of this advanced doctrine are, moreover, putting its precepts into practice. A notable example is the Division of Highways of Illinois. Other state highway officials announce that their practice will be similarly modified as conditions make action practicable.

The decision to revise standards of construction was reached at a two days' conference of the association members held in Chicago. With the highway departments of eight states represented, the standards of practice of the American Concrete Institute were considered, section by section, changed and extended as the delegates decided and the original document as altered was adopted as recommended practice. The changes extended to minor details, but only those of broad significance to the contractor call for particular mention. They include pavement design, but relate for the most part to materials and methods of construction. Quoted matter contained in this article shows the alterations as adopted.

Heavier Slabs and Better Concrete

Concrete roads less than 18 feet wide are inadvisable, but if single-track roads must be built a width of 9 feet is recommended and no road widths between 10 feet and 16 feet are approved. The width of traveled grade is set at 24 feet for all roads, and 8-foot shoulders are advised for all width of slab. A slab uniformly not less than 7 inches thick is specified for single-track roads, and for two-track roads up to 20 feet wide the minimum thickness is 7 inches at the edges and 8 inches at the center. These thicknesses are roughly 1 inch greater than those set by the standards of the American Concrete Institute.

A 1:2:4 concrete is suitable when the slab is finished by machine; for hand-finishing the proportions are 1:2:3½. Consistency is to be governed by slump tests. "For this test 6x12-inch cylinders should be tamped full of the concrete as mixed and the cylinder immediately removed. For work that is to be finished by hand, the slump of the concrete upon removal of the cylinder should not exceed 6 inches, and for work that is to be machine-finished, the slump should not exceed two inches."

Emphasis is put on the field testing of aggregates. Sieve grading, using Nos. 100, 48, 28, 14 and 4 screens, is specified. Volumetric tests for silt are approved for field determination, but unless this test shows less than 7 per cent of silt materials are not to be accepted for construction until the quantity of silt is determined by the weight method. Fine aggregate must all pass a No. 4 screen but natural sand or any mixture up to equal parts of sand and screenings is acceptable, provided the screenings are from durable stone and are without dust. For coarse aggregate, besides pebbles and broken stone, "slag of suitable quality and uniformity" is acceptable.

Stress is laid on subgrade construction. It is recommended that the subgrade be not trenched out, and that it be kept higher than the natural berms, so as to provide drainage directly to the ditches. A 10-ton macadam-type roller is recommended, and very careful

rolling is urged. "If the rolling at any time causes the subgrade to become wavy, the rolling should be stopped immediately over the wavy parts, and the soft material investigated. In clays, this is almost always due to moisture and, unless it is possible for it to dry out by the sun and wind without delaying the work, it should be removed and replaced with dry clay or other suitable material that can be rolled in a satisfactory manner. If any depressions develop they should be filled with acceptable material as the rolling progresses."

It is recommended that the rough grading be completed very close to the intended cross-section of the subgrade and to the full width of the shoulders. The finished subgrade immediately ahead of the concrete should be corrected to proper cross-section, using a templet.

Where the aggregates are stored on the subgrade the latter should be completed fully in sections not exceeding 600 feet in length, immediately before the aggregates are deposited. The surface should be brought to true cross-section, using a templet or other acceptable method, and the roller should be kept in constant operation while the aggregate is being delivered. Wherever possible, hauling over the finished subgrade with teams or motor trucks should be avoided.

Concreting Practice Made More Definite

Two-bag batch mixers are recommended for concrete-road work. The mixer should be equipped with "a boom and bucket or some other mechanical device that will deliver concrete of a proper consistency; also with an automatic timing device and a device that will accurately measure the water for each batch." The attention of mixer manufacturers "is directed to the advantages of perfecting a mixer that will shorten the time necessary for proper mixing and permit the inspection of the batch before delivery."

Duplicate pumping machinery should be provided, with booster pumps on long pipe lines. Steel side forms should be used.

The concrete may be transported from the mixer to place on the subgrade in any manner which avoids the segregation of materials. Every effort should be made to arrange for closing concrete-road work in the autumn on or about such date "as the Weather Bureau reports for the locality for the past 10 years indicate the probability of temperature materially below the freezing point." If circumstances necessitate continuing work for a short period after freezing weather is likely to occur, precautions should be observed which will insure positively that the concrete may not become frozen under the most extreme conditions of temperature for the period, "as indicated by weather reports for the past 10 years." Concrete should be absolutely protected from freezing by suitable means for at least seven days after placing.

When mixtures of relatively dry consistency are used, "mechanical strikers and tampers should be used." Machines should be so constructed and operated that they strike off and thoroughly tamp the concrete, and that they "may be readily operated over the same area repeatedly." If a mechanical finisher is not used after the spreading, the concrete should be thoroughly hand-tamped by means of a tamper "of the nature of a strikeboard operated by one or two men stationed at each end of the tamper on opposite sides of the roadway." Hand-tamping should be vigorous and sufficient to consolidate the concrete in such a manner as to leave the surface behind the final strikeboard "true to grade, crown and surface, and absolutely free from porous places."

Trained Inspectors Essential

Inspectors should be selected with great care. The remuneration of an inspector should be sufficient to secure a man of the following qualifications: "Practical experience, knowledge of specifications and construction, absolute integrity, quick decision, sound judgment, forceful personality, common sense and the ability to command the respect of the contractor." The inspector should have broad perspective and should be able to distinguish between essentials and nonessentials. It is recommended that inspectors of concrete construction receive a preliminary course of training in their duties, including a study of materials and the interpretation and significance of laboratory and field tests.

Jeffrey Standard Apron Conveyors

The Jeffrey Manufacturing Company, 914 North Fourth street, Columbus, Ohio, has issued a new catalog (No. 258) about the Standard Apron Conveyors which are made for a variety of service. It has 75 pages devoted to describing and picturing installations of these conveyors in various industries, together with specifications, general dimensions and other important data of vital interest to purchasers. The material relating to the conveyors of both steel and wood flights is so arranged that not only engineers, but laymen, more or less lacking familiarity with conveying machinery, can easily make selections to completely meet their respective requirements. There are no confusing tables to vex one's patience, but on pages 4 to 9, inclusive, are some important notes to aid customers in making a choice. Moreover, the book will be of special advantage to a purchaser, as he will save time and expense for making drawings and layouts for particular needs. In addition he is further benefited by quick delivery.

New Crusher Catalog

The Austin Manufacturing Company, Chicago, has just issued a new catalog on gyratory crushers and quarry equipment.

It is of interest to note on one page of this catalog contracting illustrations of the largest and smallest crushers made by this company, No. 1 and No. 10, six other sizes being made between these two.

The book also includes illustrations and drawings of a large number of plants, the design and equipment being with especial regard to facility and economy in handling.

The catalog includes other equipment, such as elevators, screens, bin spouts, dump cars, etc.

New \$70,000 Electrically Run Tipple

The new tipple of the Columbus Sand & Gravel Company, a subsidiary of the Columbus Builders' Supply Company, of Columbus, Ohio, is now completed and has been in operation since the first of July. It is of steel construction and electrically operated. The cost of the tipple is approximately \$70,000, and is one of the most modern in the country. It is located at the foot of Spring Street, and has a capacity of 2,000 yards per day. The Des Moines Building Materials Company uses eight motor trucks and has found that best maintenance system is to employ an expert automobile mechanic for full time. Recently on a big job the company delivered forty-two yards of sand in five hours. (This was on a distance of one and a third miles. Mr. Keefner figures that seven teams would have been required to do this job in the same amount of time.

New Jersey Concrete Road Construction

Reinforcing, Curb Protection Bars, and One-Two-Three Mix on Road Built Near Pemberton, N. J.,
Camp Dix Traffic—Surface-Finishing Concrete—Hauling Construction Materials

Practically every construction detail possible to improve the pavement is being included in a concrete road now being constructed for Burlington County, New Jersey. The contract includes 12,880 square yards of concrete, 18 feet wide, 6 inches thick on the sides and 8 inches in the center. It is reinforced with mesh, and metal curb protection bars are used to keep the edges from cracking or spalling. Carey Elastite joints, set in reinforced expansion joints are placed every 25 feet. The concrete is mixed 1:2:3. This rather high percentage of sand was necessary because of the uniform size of the gravel furnished for coarse aggregate.

The road on which the concrete surface is being built was an old dirt road, and in the reconstruction 3 or 4 inches was removed from the top in grading. No culverts had to be built and the grades, which were light, were left unchanged. All the work of preparing the subgrade was done by hand. For the most part the soil was easy to handle and, after loosening with a rooter plow, was brought to grade with shovels. A Buffalo Pitts steam roller was used to compact the subgrade in preparation for placing the concrete.

Sand and gravel are shipped in the former from Absecon and the latter by the Penn Sand & Gravel Co. No attempt is made to unload the aggregate other than by hand, though there is an overhead coal dump at the

on gravel; two extra shovelers to help the gravel barrow men; two men on sand, each man filling his own barrow; two men on forms; a fireman; an engineer; a foreman, and a couple of general utility men. A Boss mixer is used. Two bags of cement, two barrows of sand and three of gravel make one charge.

The forms are of 6-inch channel iron cut into sections 10 feet long for convenience in handling. These are held in place by iron pins or stakes driven into the subgrade. The reinforcing is placed about $3\frac{1}{2}$ inches from the bottom. Expansion joints are constructed at 25-foot intervals. The curb protection bars are put in place after the concrete has been placed and brought to the proper surface, but before any set has taken place. The concrete is mixed rather dry and the subgrade is thoroughly wet before mixing. The final treatment is given with a wood float, which leaves a rather rough surface with the sand grains on top. An earth covering protects the concrete for the 10 days necessary for curing.

Water is secured from the Pemberton water supply system and is carried through about 6,000 feet of 3-inch pipe. Plugged tees are placed about 200 feet apart for hose connections. Enough pressure is secured from the Pemberton supply so that no auxiliary pumping is needed.

The road is being built by The Utility Construction Co. of New Brunswick for Burlington County. James Logan is county engineer and in charge of all road work done by the county. F. Yocum is supervising engineer for the Portland Cement Association, which furnishes an engineer to see that all construction details which may have a bearing on the quality of the concrete are given proper attention.



Building a Concrete Road in New Jersey

station which could be rigged up for unloading aggregate without much trouble. Hauling is done by local teams, which are hired at \$6 per day. The haul from the station to the job is slightly over a mile and the teams make 12 or 13 trips a day, working 9 hours. Six men are assigned for unloading the sand and gravel, 3 men working on a wagon. Small loads, generally about a yard, are carried and three men load a wagon in $2\frac{1}{2}$ minutes.

The sand and gravel are dumped in parallel rows on the subgrade and transported to the mixer in barrows. The concreting gang comprises 26 to 28 men who are employed as follows: Four men placing concrete; two men on the striking board; one or two men finishing concrete; two men on cement; three men with barrows

Oregon Cement Company Officials Held For Trade Restraint

Accused of conspiring to restrain trade, R. P. Butchart, president of the Oregon Portland Cement Company, and Clarke Moore, general manager, will be tried in the federal court, October 31. Although the plant is located in a small town near Portland, Mr. Butchart is a resident of Todd Inlet, British Columbia, and Mr. Moore is a resident of Denver, where he is said to be sales manager of several cement companies, the stock of which is held by the Cement Securities Company, a \$10,000,000 holding company.

Nine cement companies were involved in the original charge, three western Washington companies, five California companies and one Oregon company. All, except the Oregon concern, have pleaded guilty and each was fined \$2,500. Mr. Butchart and Mr. Moore, of the Oregon company, determined to stand trial.

According to federal officials who are gathering material for the prosecution of Mr. Butchart and Mr. Moore there was a conspiracy agreement among the nine companies to this effect: California companies were to keep out of Washington; Washington companies were to keep out of Oregon and California; the Oregon company was to keep out of Washington and California. This arrangement particularly limited the zone of activities of the Oregon company, which aside from having to remain out of the markets of Washington and California, had to permit the California companies to invade its home territory. The California companies could sell in Oregon, but only on prices arbitrarily fixed by the combine.

Overcoming Difficulties in Laying Concrete in Cramped Alleys

By W. W. Horner, Chief of Division of Sewers and Paving, St. Louis, Mo.

Concrete alleys are being constructed in St. Louis this season for the first time. The adoption of this type of pavement has been deferred for several years on account of the difficulty expected in handling and finishing the concrete in cramped locations, with fences, sheds and telephone poles on either side. It was also stated freely that it would be impossible to manipulate it in such close quarters, and that the inverted alley with the center 4 inches lower than the sides, as called for in the St. Louis design, could not be belt-finished. Engineers and contractors, however, have found very little difficulty in overcoming these obstacles.

On account of certain soft ledges in St. Louis limestone, it was decided that it would be unsafe to use quarry-run stone in the wearing surface of the alleys.

There is much good stone for this purpose under St. Louis, practically all of the ledges for which the French coefficient of wear will run from 10 to 11. These ledges, however will alternate with certain soft ledges giving a coefficient of from 4 to 6, and, as handled commercially, these grades are mixed in the crusher.

With the idea of using this local stone as far as possible, the specifications permit its use in a bottom course having a thickness of 4 inches and the use of gravel in the top course having a thickness of 2 inches. The lower course is a 1:2 $\frac{1}{4}$:4 mix, and the upper

These are made of $\frac{3}{4}$ x $1\frac{1}{2}$ -inch strap iron on edge, with the two ends turned over for about a foot and sharpened for driving. The irons are 6 to 8 feet long, and are set sufficiently in the alley to avoid interference with existing structures. They are driven to grade along a line stretched between grade stakes. By slight allowance for the slope of the alley, they may be set as much as 12 or 18 inches out in the pavement.

The concrete for the lower course is deposited for a distance of about 15 feet, or the reach of the ordinary boom-and-bucket mixer. It is brought to grade, tamped lightly and covered with the top mixture, which is struck off with a templet sliding on the iron guides. The guides are set approximately $\frac{1}{2}$ -inch high to allow for compacting the concrete by rolling. As soon as the concrete has been struck off, the iron guides are pulled out and the space is filled with wet mortar. A piece of 1-inch plank is laid on top of the concrete on each side of the alley, as a working platform for the roller-man and the belt finishers.

It is found that after the belt becomes wet and the cement coated, it adheres closely to the concrete surface and can be pulled easily from side to side without lifting in the center. On completion of the belt finishing the side planks are removed, and this strip is finished with a hand float. Nine of these alleys have been completed with very satisfactory results. The average cost of this pavement is about \$2 per square yard.

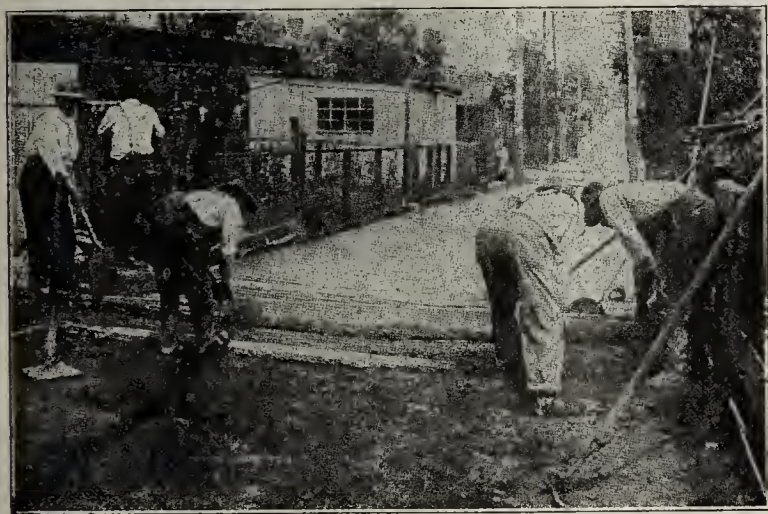
State Pulverized Limestone Plant May Soon Close Down

C. W. Courtney, superintendent of the state lime plant located at Gold Hill, Oregon, was in Roseburg recently conferring with the county agent for the purpose of ascertaining if possible the probable amount of lime that would be used in the county by farmers during the coming fall. Mr. Courtney states that unless the farmers show more interest in the matter of securing lime and send in orders more rapidly than they are doing at present that it will be necessary to close the plant down indefinitely, which would mean that the price of agricultural lime would probably be almost double what it is at the present time. Mr. Courtney states that the plant has a storing capacity of only about four hundred tons of lime, which means a 10-days' run and unless orders come in sufficient to keep the bunkers empty that it is not possible to operate the plant.

The price of lime has been raised from \$1.75 per ton to \$2.50 per ton, caused by the state removing the convicts from the plant and the necessity of hiring free labor.

Professor of Highway Engineering

Arthur H. Blanchard has been appointed Professor of Highway Engineering at the University of Michigan to occupy the Chair recently established by the Board of Regents. He will retain his consulting office at Broadway and 117th Street, New York City, until September 15th, after which he will be located in Ann Arbor, Michigan.



Striking Surface (Note Iron Guides at Right)

course must be a 1:1 $\frac{1}{2}$:3 mix. The option is given to the contractor of putting in all of the concrete in one course of the richer mix, but all have preferred to use the two-course worn and consider the saving in cement as more than offsetting the additional cost of the two course organization.

On account of the impossibility of turning the teams in a 15-foot alley, all materials must be delivered and placed on the subgrade before concreting is started. It has been found rather difficult to distribute properly a limestone aggregate for one course and a gravel aggregate for the other with proportional amounts of sand, and, to the present time, only one contractor has used the limestone in the base.

Considerable difficulty was anticipated in the placing of proper forms at the sides of the alleys, on account of the irregular line of fences and sheds, many of which will vary 6 inches on or off the alley; but this difficulty was overcome by the use of the bar-iron guides.

The Design and Equipment of the Wisconsin Sand & Gravel Company's Plant

The necessity of obtaining a clean, well graded sand and gravel at a low cost of production has been the prime factor in the design of the Wisconsin Sand & Gravel Company's plant at North Lake, Wis. Labor has been replaced with mechanical devices wherever possible, from the elimination of a cranesman on the steam shovel to the gravity movement on a car at the final loading.

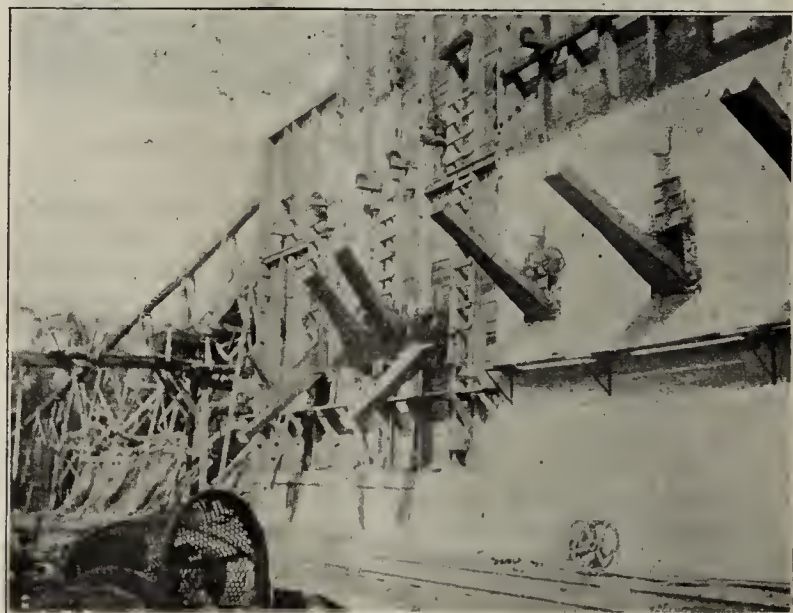
The plant is located on the Chicago & Northwestern Railroad, 30 miles from Milwaukee, and has a capacity of 2,000 tons per day. The gravel is of a glacial deposit in the form of a hill about 90 feet in height and averages 70 per cent gravel above $\frac{1}{4}$ -inch, ranging in size up to stones 16 inches in diameter. It is necessary to crush about 35 per cent of this gravel. This reduction is accomplished by two No. 5 McCully gyratory crushers, and four No. 3 crushers. The smaller crushers take the rejections from the No. 5.

The gravel is dug by a No. 40R $1\frac{1}{2}$ -yard Bucyrus steam shovel, which deposits the gravel into a movable hopper with an automatic feed. The hopper feeds on a 30-inch belt incline field conveyor which carries the material to a $1\frac{1}{2}$ -inch grizzly. The material below $1\frac{1}{2}$ inches is separated and deposited on this main incline belt, and carried to the screens. The oversize material is divided between the two No. 5 McCully crushers located at the foot of the main incline, one of which discharges directly on the main belt, while the other discharges into a bucket elevator. It is then elevated and passed over a revolving screen, the rejections from which are taken by two No. 3 McCully's, which discharges upon the main belt to the screens. The material over $1\frac{1}{2}$ inches in size passing the other No. 5 is discharged on the main belt and rejected by the main washing screens. It is then chuted to an oversize storage bin, from which it is taken by two No. 3 crushers and reduced to $1\frac{1}{2}$ inches and under. These rejections are received upon a return incline belt which discharges upon the main belt conveyor and is again passed through the screens.

The washing screens used in this plant are somewhat different from those in general use. They are commercially known as the Biesanz Stone Company screen. There are four batteries of these screens now in operation in two units. The material from the main belt is divided into two parts, one part going direct by gravity to the first set, the remainder is carried by a belt conveyor to the second set.

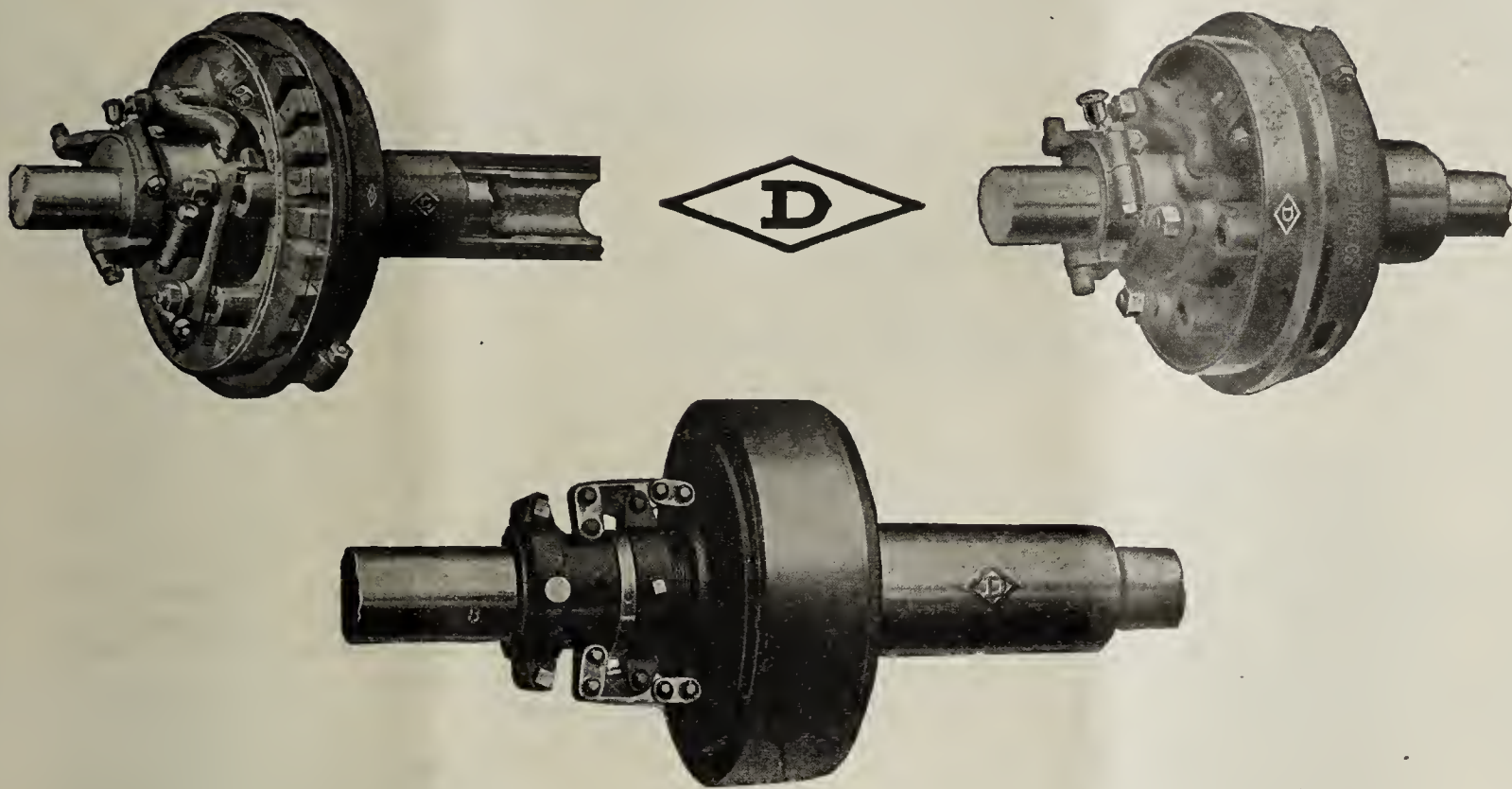
In this type of screens four separations are obtained from each screen, that is, $1\frac{1}{2}$ and $\frac{3}{4}$ -inch roofing gravel and concrete sand. In place of each screen being separately driven as is commonly done, all the sizes of one set are compactly assembled together and driven by one shaft. This has materially reduced the horse power required and eliminated considerable driving mechanism. The arrangements of the screens in one plane has increased the storage capacity over the common type of screen. They have delivered a very clean and well graded product, and have proven satisfactory in every way.

The loading is all done from one side of the plant where three cars may be loaded at one time, giving ample loading facilities. The tracks are constructed on a $1\frac{1}{2}$ per cent grade which allows all the car movements, both loads and empties, by gravity, thereby eliminating car pullers and switch engines. The empties are placed above the plant by the railroad



Plant of Wisconsin Sand & Gravel Co.

switch engine, and when the brakes are released run down to the plant, are then loaded and again run by gravity to the loaded yard.



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Water is delivered by an American centrifugal pump, running at a capacity of 1,000 gallons per minute with a 125 foot head. The water supply is obtained from a well, there being an abundant supply of water at shallow depths; 10-inch cast iron water mains are used for conveying water.

Three automatic settling tanks are used to collect the sand. These tanks are of a rectangular, balanced, side-discharge type and give very satisfactory results.

The stripping problem has been very simple, as on practically all the reposit gravel comes to the surface and no stripping is necessary. In some places from 6 to 24 inches of clay is found and is removed with a stiff-leg derrick, equipped with a drag line bucket. The material is deposited into a small car which runs by gravity to railway cars.

All machinery except the steam shovel is driven by individual motors, either belt or direct connected.

Modern Methods of Fine Grinding

By George S. Emerick

A number of articles have been written and many theories advanced regarding the proper method of furnishing finely ground raw materials to the kilns used in Portland cement manufacture, as well as producing at a low cost, a finely ground finished product.

An economical method of rapid grinding is the feeding of material in large volume continuously to the grinding units. The material discharged from the grinder should then be passed to a separator, which extracts the fines from the coarser particles, known as tailings. The tailings are then returned to the pulverizer to be re-ground and again passed to a separator for separation. In other words, a fast and continuous circulation of material must be kept up between the pulverizer and separator to insure economical grinding.

For example: Take 6,000 pounds per hour of material and pass this through the type pulverizer equipped with a finishing screen. The result will be 6,000 pounds or three tons of finished material per hour. This is the usual result obtained from the ordinary type pulverizer equipped with a finishing screen.

For another demonstration, take 12,000 pounds per hour of material and pass this through the ordinary type pulverizer equipped with a coarse or scalping screen and figure on reducing three-fourths of this material, or 75 per cent, to the desired fineness, extracting this amount by air separation, and the result will be 9,000 pounds, or 4½ tons finished material per hour, an increase over the former method of 50 per cent.

This, however, is not the maximum of economy and we will demonstrate this by the following example:

We will now use a mill without any screens whatever and pass through 25 tons of material per hour, reducing 40 per cent of this amount to the proper fineness, which will be extracted by the air separator. The result will be 40 per cent of 25 tons, or 10 tons of finished material per hour, an increase of over 200 per cent over the first method and more than 100 per cent over the second method.

This result can be accomplished without additional power, as the power expended to circulate the large volume of material in the latter method is used in the mill equipped with a finishing screen to handle the material fed to it continuously until finished.

It has been proven in actual operation that separating equipment and elevator with sufficient capacity for two mills will absorb less than 15 horsepower.

It is impossible to use this method in connection with a grinding machine that is equipped with a finishing

screen for the reason that if this type of grinder is fed with the same amount of material passed through a grinder without screens, the screens would become congested and choke up in a very few minutes. It is also important that the grinders used in connection with separators have freedom to discharge material as fast as it is fed to it.

There are a number of people who are interested in the manufacture of Portland Cement who have been led to believe that tailings from an air separator are made up of particles of material that are the hardest and most difficult to pulverize and statements have been made to the effect that a tube mill is the only practical machine to pulverize them in. The fact that an air separator used in conjunction with a pulverizer when the finishing screens are removed will increase the capacity of these mills from 40 to 75 per cent (depending on the operator), is proof beyond dispute that the above statement is untrue. In operating these mills with an air separator the finishing screen is replaced by a very coarse one, which permits passing a large quantity of material through these mills, creating a rapid circulation, inasmuch as the tailings, are returned to the same mills to be re-ground. The cost of repairs is invariably cut in half, due to the cushioning effect of the large volume of material, and more operating hours are obtained; the fineness and quality of the material is also improved.

Tailings is that portion of material passing from a grinding machine that has not been subjected to as much grinding as the portion that passes from the grinding machine of the proper fineness, irregardless of the hardness of the material. Some of the less refractory material will pass from a tube mill that will not be of the required fineness.

A certain portion of material within the grinding zone of mills equipped with finishing screens is also tailings and will remain tailings until it has been ground fine enough to be blown through the finishing screen. If the material fed to a pulverizer was all subjected to the same amount of grinding or would pass between the grinding surfaces equally the percentage of tailings would be reduced to the minimum, but under ordinary operating conditions tailings are the greater amount, and that portion of material fed to a pulverizer that has escaped the grinding units, and not necessarily made up of any portion harder than another.

grinding capacity when using a pulverizer equipped with It is absolutely impossible to obtain the maximum a finishing screen.

When operating pulverizers equipped with finishing screens the least moisture in the material (sometimes moisture in the air), will choke the screen, the mills will fill up and must then be opened, screens cleaned and the mill relieved of its over-burden. Oftentimes foreign matter, such as bolts, nuts, etc., are fed into these mills and as a rule they are thrown against the screens with such force as to break them.

Material from a mill with a broken screen that reaches the kiln bins or stock house causes considerable annoyance, expense and delays, whereas if the mills were operating with an air separator this could not occur.

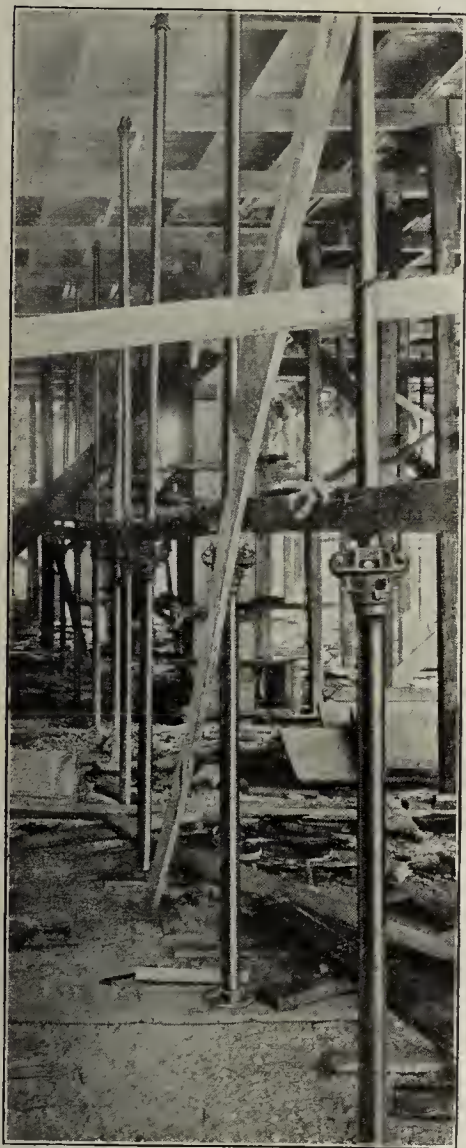
It is quite evident, as well, that the wear must be rapid to a finishing screen inasmuch as the material is blown through the screen at a high velocity. If you question the velocity, operate one of these mills for a few moments with the outside casing removed and note the distance the finished material will be thrown from the mill.

Statements have been made that material separated by air does not contain the same percentage of impalpable powder as that separated by screens. Following

Mr. Contractor:

Jiffy Labor-Savers Make Money for You

Wood shoring costs approximately $3\frac{1}{2}$ cents per square foot of floor area. **JIFFY ADJUSTABLE JACKS** easily do the same work—and do it better—for *less than 1 cent per square foot*. This saving will help secure contracts.



Jiffy Jacks are here shown making money for Fred Drew, Inc., Woodward Bldg., Washington, D. C., on the Kennedy Apartments. Jacks are set full height under 14-inch floor slab.



Jiffy Double Head Jack for flat slab work.



Jiffy Deep Joist Jack keeps a deep joist from canting.

Jiffy Jack
Brace
Clamps
Jiffy Trench
Jacks
Jiffy Scaffold
Hangers
and Other
Concrete
Appliances



Jiffy Panel Jack for temporary work or reshoring.



JIFFY Column Clamp Also Means Bigger Profits

Simplest and quickest to set. Requires no wedging. No dead space in its adjustment. Automatically squares column. Positively closes all cracks. Also made for round columns. No small parts to get lost.

WRITE FOR FACTS AND PRICES

Paul W. Koch & Company, Lees Bldg., Chicago

are two tests for fineness made by a competent chemist of finished cement made at a plant using air separation:

	Sieve Fineness		
	100	200	300
(1)	93.2	84.8	80.1
(2)	94.4	86.7	82.3

Some chemists claim that an air separator will change the raw mix. Successful operators with years of experience in this direction do not find this to be the case.

Put An End to "Contractor Discord"

By Edwin Zedler, of the Foster Construction Co., Milwaukee, Wis.

"Put an End to Contractor-Discord" is one of the slogans of the Foster Construction Company in their advertisements to architects. The cost-plus-percentage way of doing work will appeal to a great many contractors. That is one solution of the contractor-architect discord and to the fair-profit-for-the-contractor-without-skinning-the-job problems which the Foster Company offers to the public.

We are making building a profession—"Foster System" we call it, "Economy—Rapidity—Satisfaction." Economy is secured by buying in co-operation with the architect or owner and by the absence of losses due to misunderstandings. There is no poor work to be rejected. Rapidity will be secured since there is no incentive to delay; the price is fixed in advance and there is nothing but a desire to finish the job and take the profit.

Satisfaction to the owner and architect is assured because the contractor has no incentive to do anything else than to do the work thoroughly and to their full satisfaction. In short, this is his one interest in the job. He can devote all of his energies and ingenuity in working for their owner instead of against him.

Satisfaction is the basis of this kind of work. The contractor's next job—in fact his whole future—depends on what satisfaction he gives. If he can finish the work ahead of time and under the estimate, he has increased his reputation, which is his chief stock in trade. We believe "Foster System" is right and refuse work on any other basis.

Cost-plus-percentage or cost-plus-a-fixed-sum methods are increasing in popularity. A contractor that is reliable, competent and efficient soon obtains a good reputation and architects will welcome a chance to give the contract to someone who will cooperate with them—if they can only trust him.

In competition with others who have submitted lump-sum or unit-cost bids a contractor who wants to get a job on a percentage basis will work out a detailed estimate, take it up with architect, go over it item by item, and in each case show how he arrived at the amount, first that it is correct, second that no other contractor will be able to do the work satisfactorily for less.

When you can convince the architect that with your equipment, your organization, your ability and experience you can actually do the work, quality for quality, for less than your competitor, get it done more promptly and give the most thorough satisfaction, the architect will begin to consider, and you will not have a hard time to persuade him that you are entitled to a percentage profit in the same way that he is.

This is an economically sound way of doing contract work and just as soon as contractors will realize that

it is every bit as important that they give satisfaction on this basis as that they make a profit under the old basis of contract let to the lowest bidder, will this method be widely accepted.

Ten Concrete Ships Now Building at Port Arkansas

The McDonald Engineering Company of Chicago is constructing forms for 10 concrete ships at its shipyards on Harbor Island, just across the channel from Port Aransas, Texas. It will build these vessels for the French & Canadian Transportation Company. Each of the ships is to cost approximately \$200,000 and will be 53 feet wide, 21 feet deep and 300 feet long. They will be used for transporting oil from the fields of Mexico to Port Aransas, and possibly to other Texas ports. The cement for building these vessels is manufactured in San Antonio. They will be furnished with modern engines, wireless equipment, and will have 2,200-ton capacity deadweight, that is a carrying capacity of 14,000 or 15,000 barrels of oil. They will be made in sections and reinforced with steel, so that when they are launched they will slide into the water from the incline foundation, which extends out into the deep channel. The frames and scaffolding necessary for constructing the vessels are well under headway and the work is progressing rapidly. The building of these vessels may lead to the development of a great shipbuilding industry at Port Aransas if the experiment proves satisfactory and a financial success.

There are several concrete oil tanks to be constructed, with a holding capacity of 55,000 barrels. The first one of these structures is completed with the exception of the roof.

A depth of 24 feet on the bar at the mouth of Aransas Pass and 23 feet in the channel is claimed. The work is being carried on that will give a depth of 25 feet on the bar and at least 24 feet in the channel.

Nevada May Have State Cement Mill

The Nevada state legislature has passed, and the governor has approved an act authorizing the Governor to appoint a commission of three to investigate the feasibility of the construction of a cement plant for the state. Section 3 of this act authorizes the State Board of Examiners to prepare and issue bonds in the sum of \$100,000, the proceeds from the sale of which bonds are to be appropriated for the purpose of constructing and equipping such cement plant. This commission is to make a report of its findings to the 30th session of the state legislature, which will meet in 1921. There has been no report of the work of this commission.

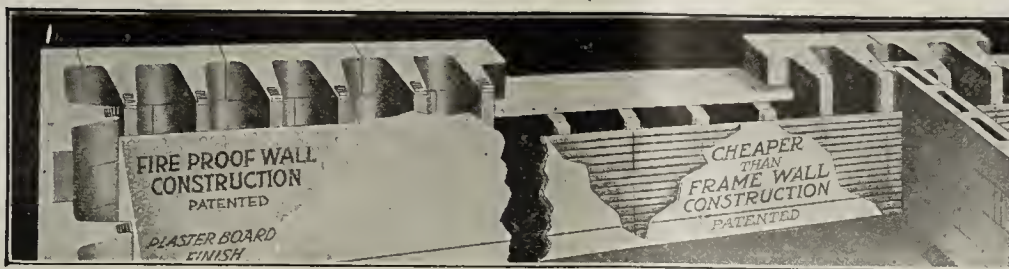
Concrete Pavement

\$6,500,000 for good roads is what the citizens of Dallas County, Texas have just voted. And they have already decided that of the roads improved, 85 miles at least must be concrete.

Maricopa County, Ariz., of which Phoenix is the county seat, is going to spend \$4,000,000 for paving 172 miles of its county.

A few years ago, a state would have hesitated to suggest such expenditures for roads. Today, a county thinks nothing of it if it gets its money's worth—and the public is learning to get its money's worth when it comes to road improvement.

SYNSTONE PRODUCTS

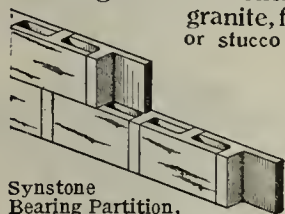


This SYNSTONE SINGLE WALL is being used for rebuilding Halifax.

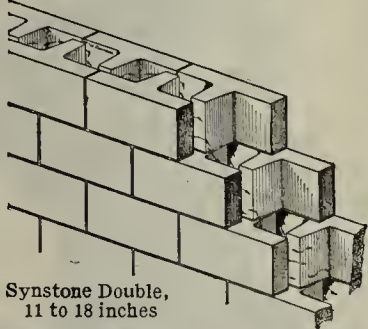
The Last Word in CONCRETE Construction

Costs Less Than Any Other Practical Wall Construction

Wet process, making real Concrete walls, impervious to heat, cold and moisture, fireproof and everlasting. Hollow Concrete Walls, stronger than brick, faced with beautiful natural material—crushed granite, feldspar, marble or sandstone, with all the sparkle and life of natural stone. Brick or stucco facings if desired. A wet, soggy mixture, 1 cement, 2½ sand and small gravel, 4 parts or 1" stone or gravel, producing stone withstanding 3000 lbs. pressure per sq. inch and 1700 degrees heat for one hour without injury. Complete machinery making all walls and all shapes and sizes of blocks required for them, by simply hooking on another core. Every block perfect with true edges. Unskilled labor, one, two or three men, capacity 50 blocks or 100 sq. feet per hour.



Synstone Bearing Partition, 3 to 12 inches



Synstone Double, 11 to 18 inches

SYNSTONE SINGLE WALL—½ as much material and labor as in any other concrete wall



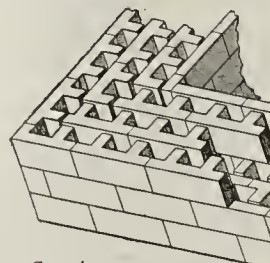
SYNSTONE MACHINE

Send for catalog.

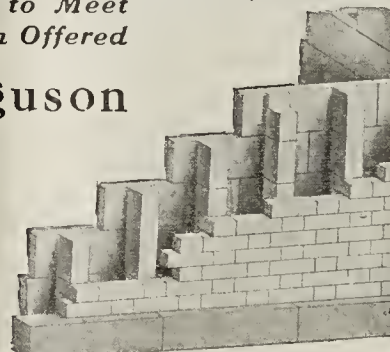
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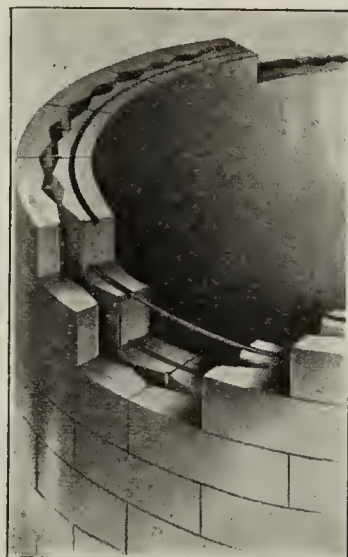


Synstone Brick Veneer Wall, 13 to 17 inches

ANCHOR



Anchor Tamper over Anchor 24" Building Block Machine



Anchor Continuous Air Space Silos Are Frost and Moisture Proof



Anchor Ventilated Corn Crib. Two Blocks made each operation. Each Block 24"x4"x8"

One Anchor Block Machine with a few attachments makes all of the above types of blocks and several others. The same Anchor Tamper tamps them all. Any block with cement connections will conduct frost and moisture. The Anchor Block will not.

ANCHOR AUTOMATIC TAMPERS

are built to operate over any make of BLOCK, BRICK, or SILO STAVE Machine. Guaranteed to give satisfaction. This tamper seldom, if ever, needs repairs. We justify this claim by guaranteeing to furnish all repairs for THREE YEARS absolutely FREE.

For catalog describing our Block Machinery, Tampers, All Steel Silo Doors, Silo Scaffolds, etc. Write

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All-Steel Machines for All Kinds of
Circular Concrete Construction

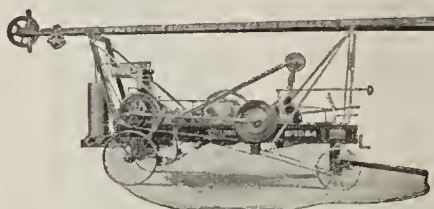
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A Big Blast-Hole Drill That's Reliable



The Cyclone No. 14

Heavy, solidly braced frame—Sill timbers 4" x 14". All machinery placed directly on the main sills protecting it against strains and preventing top heaviness. **Eighty per cent (80%) of the castings are cast steel—not cast iron.** The Cyclone No. 14 is the only Blast-Hole drill so built. Furnished in Steam, Gasoline, Compressed Air or Electric Power; traction or non-traction.

The Sanderson Cyclone Drill Co., Orrville, Ohio
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"AMPERE"
(Canvas Stitched)
"WHITE SEAL"

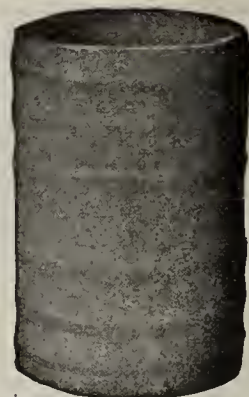
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Drain Tile Sales Will be Larger Than Ever

The farmer is urged to still greater crop production; not a square foot of land can be left uncultivated. A huge amount of drainage will mark next year's activities; drain tile will be at a premium.

Every concrete products plant should get in shape to handle the biggest spring business in drain tile ever known. Almost every plant is capable of making tile at very little additional outlay. We post you on manufacturing and furnish all equipment.

Dunn—the Standard Machine

Ninety per cent of high grade tile is made on the Dunn machine, because it absolutely guarantees a strong, lasting and superior product. Double packing and double troweling are features only of tile that are Dunn-made. Easily better than clay tile, and can be sold in competition with it.

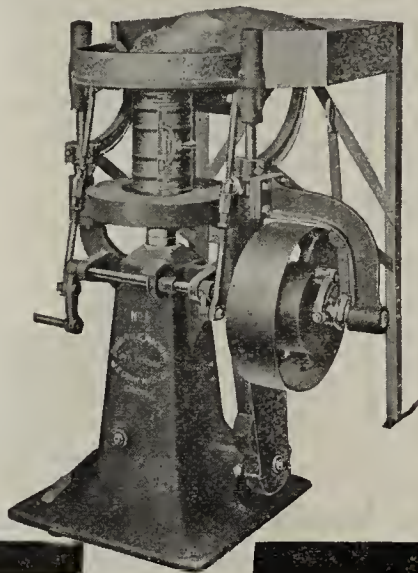
The Dunn machine makes manufacturing easy and highly profitable, and is sold at a lower price than any other machine of its capacity. Write for bulletins on the machine and the business.

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*For Stucco Dashing and Block Facing
Beautiful, Artistic, Everlasting*

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BECAUSE WE SPECIALIZE ON

Lock Seam Pipe

with the smooth inside surface, having already furnished large quantities for Potash Recovery plants, we are able to give especially careful attention to the construction of this class of Pipe.

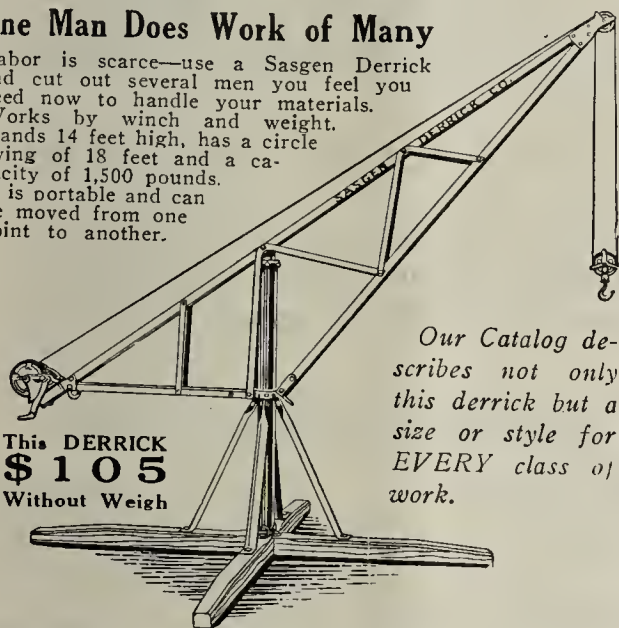
Robertson Bros. Mfg. Co., Chicago

Load and Unload With a Sasgen Portable Derrick

The Sasgen Circle Swing Counterweight Derrick cuts costs, labor and time loading or unloading material from cars or wagons.

One Man Does Work of Many

Labor is scarce—use a Sasgen Derrick and cut out several men you feel you need now to handle your materials. Works by winch and weight. Stands 14 feet high, has a circle swing of 18 feet and a capacity of 1,500 pounds. It is portable and can be moved from one point to another.

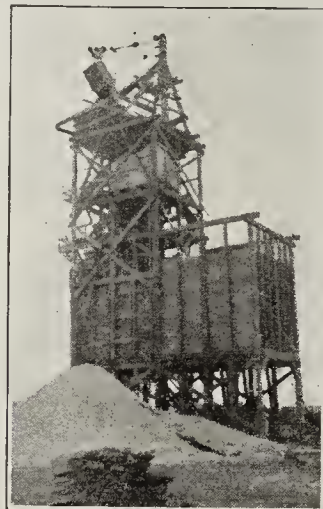
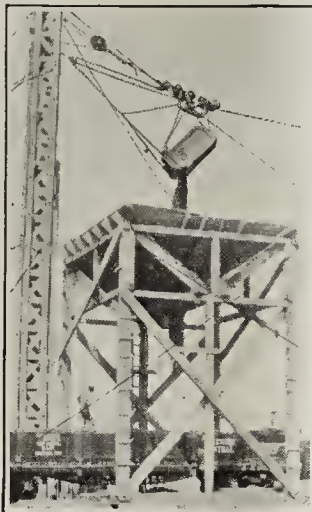


This DERRICK
\$105
Without Weigh

Our Catalog describes not only this derrick but a size or style for EVERY class of work.

Sasgen Derrick Co., 3117 W. Grand Ave., Chicago

How to Simplify Excavating and Conveying of Materials



IF you have work involving excavating material and conveying a distance of 300 to 700 ft., why not use a one-man excavator that will not only dig, but also lift and convey the material to the desired point and dump it into bins, hoppers, cars, piles or embankments? Thus you can do away with an intermediate conveying system and decrease your labor, machinery and up-keep cost.

SAUERMAN DRAGLINE CABLEWAY EXCAVATORS

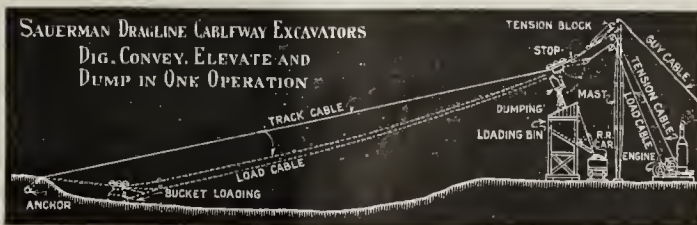
have been successfully installed for the following classes of work: Excavating sand and gravel from wet or dry pit; loading ballast; reclaiming ore from stock piles; reclaiming coal from storage; backfilling retaining walls; deepening rivers; building levees; building earth dams; stripping clay beds; cleaning reservoirs.

Have you an excavating problem to solve? If so, the experience of our engineers in planning hundreds of installations of our machines is at your service.

SAUERMAN BROS.

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Cable Excavators—Power Scrapers—Cableway Accessories.



"Stonekote" residence at Hinsdale, Ill.

"Stonekote" Rough Cast

The only cement plaster for all exterior surfaces—rough cast, float coat, trowel finish, or polish finish. As hard as natural stone; made in any non-fading color desired. Stonekote is shipped as a dry material; any mechanic can mix and apply. It is the only perfect waterproof and wear-resisting plastic finish to give permanent and delightful results.

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Garden City Sand Co.

25 North La Salle Street
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THE ONLY SCREW HOLES IN THE WORLD



You drive the screw holes with a hammer in any material.

The screw holes are made for wood screws or machine screws to fit all sizes of screws. The head is removed and you leave a permanent screw hole.

The Stine Screw Holes Co.

Manufacturers

WATERBURY, CONN., U. S. A.

DEPARTMENT 9

*Once a Screw
Hole, Always
a Screw Hole*

*The Biggest
Little Thing
in the World*

Some of the Reasons Why Screw Holes Will Be Bought and Used and Not Become Dead Stock for Anyone

- 1—They can be used without damage to receiving material.
- 2—They enable you to standardize to wood or machine screws in all material.
- 3—They are made of brass and will not rust under atmospheric or moisture conditions.
- 4—**ECONOMY**—They save more time value than the holes cost.
- 5—You get them for nothing and are paid for using them when you count time saved.
- 6—Screw holes have been needed ever since the first screw was used.
- 7—Special tools are **NOT** needed in using them in any material.
- 8—They can be used in any place a screw can be used.
- 9—By using screw holes, screws can be used in many places, and in many materials where it is impossible to use screws without them.
- 10—These are the only ready-made screw holes in the world.
- 11—No special screws are needed. These screw holes fit any wood screw or machine screw now in stock.
- 12—They make the neatest possible job in any material.
- 13—Every store where screws are sold must carry them in stock, because the line of screws is not complete without screw holes for them.
- 14—Every shop and factory where screws are used must also have these screw holes to fit the screws.
- 15—They are endorsed by all dealers in screws and by all users of screws.
- 16—Screw holes are entirely new and the world supply is yet to be furnished.
- 17—This is a progressive Old World of ours, and every active person in it must adopt all improved methods, and all new articles that will help him keep in the front line of progress.
- 18—Be among the first to stock up in screw holes if you are a dealer in screws.
- 19—Be among the first to install screw holes in your shop or factory, as you begin to save money soon as you use them.
- 20—In spite of the high cost of brass, screw holes are yet cheap.
- 21—We are letting the world know that screw holes can now be secured, by means of extensive advertising in all the principal Trade Journals that have the largest circulation among dealers in screws as well as users of screws.
- 22—Do not let your customer ask you for screw holes before you have them in stock. **BE A LIVE WIRE.**
- 23—They make everlasting holes in any material.
- 24—They mean "Plug-No-More" screw holes.
- 25—They are the result of Necessity being The Mother of Invention.
- 26—Anyone who can drive a nail can use screw holes.
- 27—Send for a sample and convince yourself.
- 28—Mechanics who see them say, "What do you think of that?"
- 29—In fact there are **NO REASONS** why screw holes should **NOT** be used.

Each of these reasons are enough to sell Screw Holes. There are many other reasons.

Write at once for our handsome **Color Card** showing screw holes in various materials which will be sent on request, together with samples and price list.



Steel Reinforcing Bars

Three grades: open hearth steel (new billet stock), "medium" and "hard" grade, and rail carbon steel (re-rolled). Both theory and practice agree on the design. Rounded corners prevent splitting of the concrete. Bending, fabricating and setting are easily done with these bars.

Sizes $\frac{3}{8}$ to $1\frac{1}{4}$ inch. Lengths up to 85 feet. Shipments can be made promptly

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STEEL BARS
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We can meet your Reinforcing Steel Requirements. This means not only quick shipment from the mills but co-operative service for rapid transportation. If you want to know just what your exact cost will be, send us the Blue Prints and we will give you a lump sum bid on all the steel sheared to lengths, bent to specifications and delivered to the job.

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QUALITY **SERVICE**

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Many buyers now take advantage of facilities at mill by ordering bars cut to length, bent to shape, and tagged—ready for placing.



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Twisted Squares Plain Squares
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Use "Scully Service" for All Your Steel Requirements

*Have you our Stock List and Reference Book?
Sent on request*

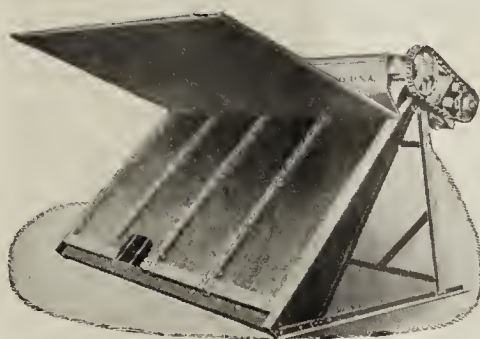
SCULLY STEEL & IRON CO.

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National Screen Separator

THE LEADING SCREEN IN

**Efficiency
Durability
Simplicity**



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Nine Good Reasons for Electrical Blasting

- 1—With an electric blasting machine you can fire from one to one hundred and fifty charges simultaneously.
- 2—Electrical blasting allows better tamping and fullest confinement of the gases.
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- 4—Less smoke and fumes and quicker return to the working face.
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- 7—The shot-firer stands at a safe distance and does not operate the blasting machine until everyone is out of the danger zone.
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- 9—The dependability of Du Pont electrical blasting equipment, that leaves nothing to chance, but gives the operator control of the entire blasting performance. Du Pont blasting accessories are correct in design and efficient in service. They are the result of practical experience and scientific research—the last word in modern, sure-fire blasting equipment.

A free copy of our "Blasting Supplies Catalog" will prove helpful. Write for it today to Advertising Division.

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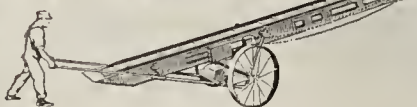
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Saves 6 to 10 Men
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**Pyrometers, Calorimeters
High Grade Goods Only**

Satisfaction Guaranteed



Austin Cube Mixers Insure More Mixing In a Minute

A mix-a-minute specification does not make all mixers equal.

Austin Cubes give 25 to 40% more mixing action in a minute because they mix by kneading.

Additional mixing in a minute makes **Cube Concrete extra-workable**—it is more easily spread and tamped and finished.

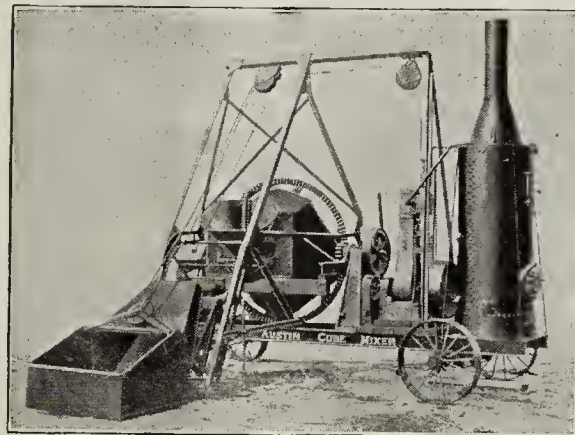
On much work where pasty concrete is specified, the 25 to 40% additional mixing given a minute batch by an Austin Cube increases materially the ease of placing and compacting and smoothing the concrete slab.

When time of mix is not specified, the intensive action of the Austin Cube produces a mixture of required perfection in two-thirds to three-quarters of the time required by machines which do not mix by scientific action—by incorporation under pressure.

Interlining Plates Make Cubes Everlasting.

Send for your copy of book which describes the complete line of Austin mixing machinery with specifications, drawings, production records, data on length of life, repair costs, etc.

Ask for Catalog No. 21.



For those who prefer the "blade" type drum the **Austin Drum Mixer** is the logical choice. Wide loader and opening into drum permit fast charging without clogging.

Design of mixing blades such that the mix is carried over on discharging chute very wet, allowing rapid discharge, either entire batch or part. Capacity 60 to 80 cu. yds. per day. Nowhere has it found its equal in round drum mixers.



If a mixer of this type is desired ask for Catalog 21-D.

THE F. C. AUSTIN LINE

Trenching machines
Backfillers
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Drag Line Excavators
Dry Land Dipper Dredges
Levee Builders
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Wheel Tractors

Wagon Loaders
Cube Concrete Mixers
Cube Pavers
Cube Hot Mixers
Drum Mixers
Drum Pavers
Asphalt Mixers
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F. C. Austin Company, Inc.

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SPECIAL FOR LEASE OR SALE

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Several Clam Shell Buckets, Various Sizes

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Showing Complete Stock and Net Prices.

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Diesel Oil and Gas Engines, Generators, Motors

First-class Condition Prompt Delivery

AMERICAN DIESEL OIL ENGINES:

- 1—120 BHP. Vert. 3 cyl. belted.
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WANTED — SUPERINTENDENT
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CHEMIST.

A highly competent and efficient chemist with ten years' experience as chief chemist and superintendent wishes to communicate with a company having such a position open. Address C. D., c/o Cement and Engineering News, 672 Transportation Bldg., Chicago.

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We have positions open for the following:

Three experienced Cement Plant Superintendents, \$3,600 to \$5,000 per year.

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1—Complete Portland Cement Plant, located in Middle West, ready to operate. Was run only a few months. A great bargain. For full particulars and prices, write—

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all weights and cut to any length
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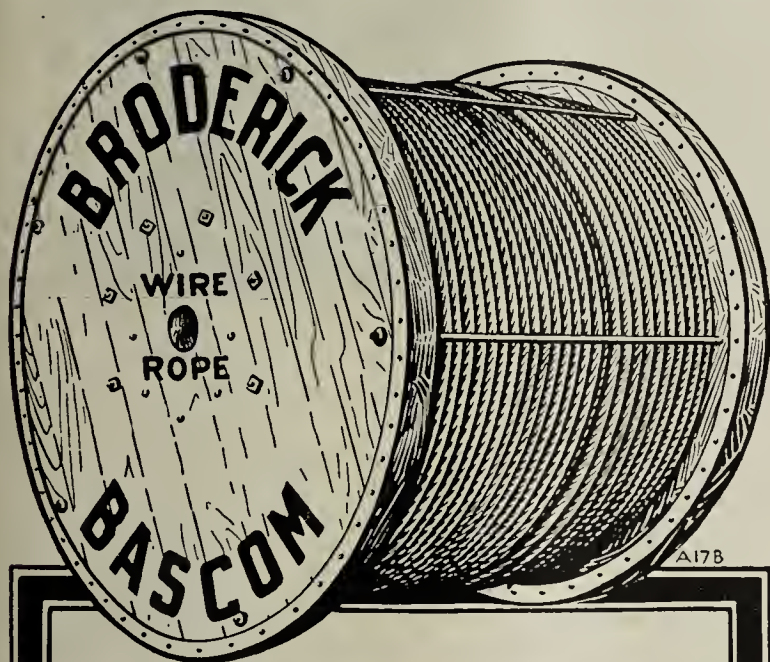
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Measure B & B Wire Ropes against the requirements you demand in the best hoisting line. They're flexible, steel-strong, durable.

With those requirements successfully met, B. & B. Wire Ropes are bound to be dependable and economical. Write for Catalog 60

BRODERICK & BASCOM ROPE CO., St. Louis, Mo.

Manufacturers of Celebrated Yellow Strand and all standard grades of Wire Rope

Braunches: New York and Seattle

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Completely Equipped Cement Plant Stockertown, Pa.

CAPACITY OF 2,000 BARRELS PER DAY

A series of 1-story buildings, all directly connected, including boiler and engine room, drying and grinding rooms, kiln room, engine room, machine shop, baggage room, cooper shop and storage limestone bins, etc. LARGE POWER PLANT. L. V. & N. E. R. R. SIDING. 69 acres. LARGE CEMENT QUARRY, DEEP FACE. Heart of cement country. Excellent labor. STOCKERTOWN, 5 MILES FROM EASTON, PA.

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For Sale—Second-hand industrial cars and track. Twenty-five 1½-yard 24" cradle dump cars. Twelve 1-yard Lakewood V type dump cars. Ten thousand feet track. Eighteen switches.

For Sale—One brand new 1-yard Page Drag Line bucket, Chain hoist bale, heavy magneese steel cutting edge, carbon steel trunions and two-part magneese steel teeth.

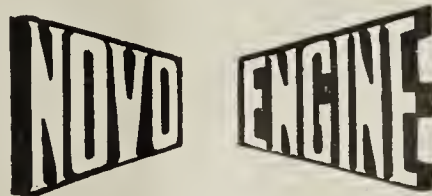
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This is one of several reasons why the Novo Engine proves so economical and why it should appeal to every contractor. Then the Novo is so light—the lightest engine for power developed—that a lot of time is saved in moving your mixing outfit. Time lost soon runs into money.



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The absence of lateral vibration adapts the Novo particularly to the running of cement machinery. Ten sizes, 1 to 15 h. p.

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and look into this question of power. It is worth careful consideration.

Novo Engine Co.

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Clarence E. Bement
Sec'y and General Manager

Lansing, Mich.

INVESTIGATION AND EXPERIENCE ARE PROVING THE RELIABILITY OF HYDRATED LIME

FOR WATER PROOFING AND TO FACILITATE POURING CONCRETE



In these 51 concrete storage tanks, recently erected in Cedar Rapids, Iowa, by the Quaker Oats Co., there are approximately 12,500 cubic yards of concrete—1-2-4 mix. The walls are perfect cylinders, with no lips or bulged surfaces.

Hydrated lime was used for waterproofing and also to facilitate pouring the concrete and lifting the forms, owing to its lubricating properties. In mixing, 25 pounds of hydrated lime was put into each batch, which made the percentage of lime to cement a little over 8% by weight. The mixers used were of such size that three bags of cement could be used in each batch.

Considerable credit is given by the Leonard Construction Co. of Chicago to the lime. The statement is made that the lime gave the exterior surface a white and uniform appearance, and that the surface needed no subsequent coating. There were no joints where the concrete stuck to the forms and "lifted," as it does in many cases where the concrete is not of uniform mixture.

Write any of the following competing manufacturers of Hydrated Lime for complete information about Hydrated Lime in Concrete

Marblehead Lime Co., Chicago—Kansas City	Ste Genevieve Lime Co., St. Louis, Mo.	Kelley Island Lime & Trans- port Co., Cleveland, Ohio	Woodville Lime Products Co., Toledo, Ohio
Port Byron Lime Assn., Port Byron, Ill.	Palmer Lime & Cement Co., 103 Park Ave., New York, N. Y.	National Lime & Stone Co., Carey, Ohio	Merion Lime & Stone Co., Norristown, Pa.
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White Marble Lime Co., Manistique, Mich.	O. C. Barber Allied Industries Co., Canton, Ohio	John D. Owens & Son Co., Owens, Ohio.	Vermarco Lime Co., West Rutland, Vt.
Glencoe Lime & Cement Co., St. Louis, Mo.	Hunkins-Willis Lime & Cement Co., St. Louis, Mo.	Riverton Lime Co., Riverton, Va.	Union Lime Co., Milwaukee, Wis.



A 5-Ton Truck Load of Bank-Run Material Every Six Minutes

With this

Jeffrey Self-Propelling Loader

Effectiveness in loading sand and gravel direct from bank to truck is illustrated in the above installation.

Being self-propelling and self-feeding, the Jeffrey Loader will work along the bank wherever desired, loading material at the rate of 1 to 1½ cubic yards per minute. When a specific size of gravel is desired, the different sized screens can be easily and quickly changed.

The Jeffrey Self-Propelling Loader will enable you to conserve the energy of your shovelers and place them on easier and more productive work, and at the same time load more material at less cost.

Write for Bulletin No. 177-L showing how Pit and Quarry Owners, building Supply Dealers, Contractors and Industrial concerns are profiting by its use.

The Jeffrey Mfg. Co. 914 North Fourth St. Columbus, Ohio

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Handle it Mechanically

CEMENT AND ENGINEERING NEWS

with which Gravel & Stone Magazine is incorporated

22 Quincy Street, Chicago.

(PUBLISHED MONTHLY)

William Seafert, *Publisher and Editor*

J. F. Waldron, *Advertising Manager*

R. M. McCully, *Business Manager*

Telephone, Harrison 5397

Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879

SUBSCRIPTION RATES:

United States, Canada, Philippine Islands and Mexico, \$1.00 per year; all
other countries, \$1.50 per year.
Single Copies 20c.

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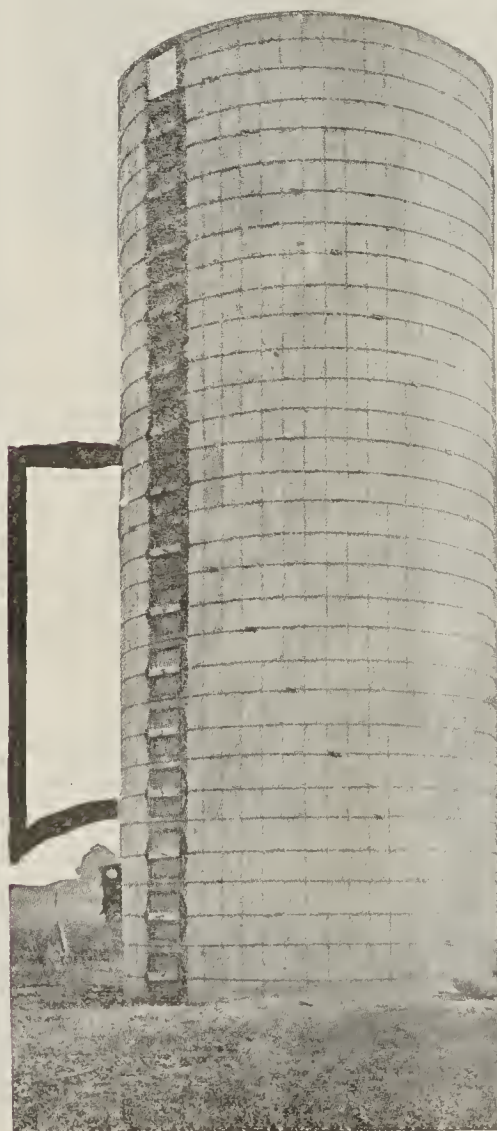
Advertising copy or changes in ads. must be in this office by the 25th of each
month, as hereafter our magazine will appear on the 5th of the following month

Advertising Rates Sent on Application

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You, too, Can Make This Year Bring \$4,000 Profit

Hundreds of concrete men are building cement stave silos on the "Monarch" plan—and clearing from \$4000 to \$8000 a year. That's worth while. We believe you can do it. Why not? The field is ripe, the way clear, the method simple, the means within your reach.

WE START YOU—WE BACK YOU!

We set you off on the right track. We help you manufacture, we help you land order; we help you build the first silos. We keep you constantly in touch with the methods found best by the hundreds of "Monarch" silo men the country over. You benefit by their experiences.

QUICK ACTION—QUICK RESULTS

Now is the time to start. Silo building is in a big boom. The Spring and Summer lie before you—and that is building time. The sooner you get in, the sooner you begin to take in those profits.

Fill out the coupon. Mail it today. That is the first step in your big-profit career.



NEW MONARCH MACHINE & STAMPING CO.

S. W. 9th & Murphy Sts., Des Moines, Iowa

Send me immediately without obligation on my part complete and full details of the cement stave silo business and complete catalogue of silo hardware.

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**MIXES
MORTAR
OR
CONCRETE
IN**

**ONE
MINUTE**
For Mixing and
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Patented
High Speed
Remixing
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Discharging
Action.

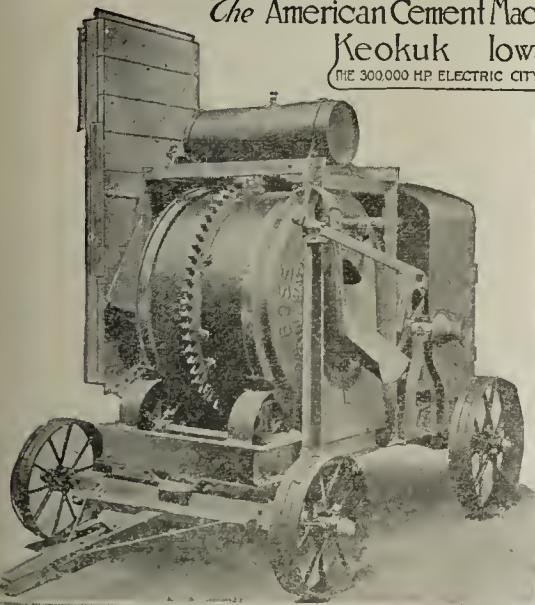
Guaranteed
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Built of Steel—lighter and more compact.
"High Speed" Mixers with Hyatt Roller Bearings, and Steel Roller Pinion Drive in ½, 1, 2 and 3 bag sizes. Gas or steam.

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THE 300,000 HP ELECTRIC CITY



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Cities Below.

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*After the
storm—the rainbow.*

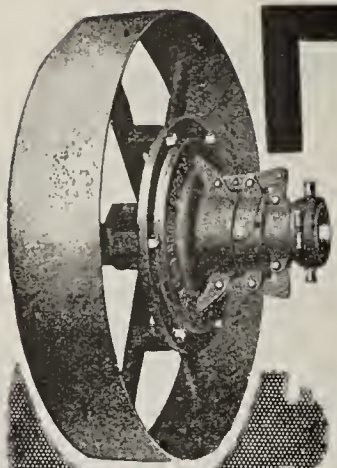
*After the usual run of transmis-
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ments—Rainbow Friction Surface
Belting.*

The Engineer will tell you why.

**"The Right Belting
the Right Place"**



United States Rubber Company



**DUST
PROOF**

**VERY
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**DOUBLE
TOGGLES**

**SOLID
CLUTCH**

**ONE COLLAR
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**NO
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AS DESIRED**

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**ALL PARTS
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**EASILY
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We have a 57 years' service record for this clutch.

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MFG. CO.**
12 to 24 N. Clinton Street
CHICAGO, ILL.

We manufacture Spur Gears, Bevel Gears, Miter Gears, Spur Mortise Gears, Bevel Mortise Gears, Miter Mortise Gears.



Spur,
Spiral,
Bevel and Worm
Steel and Rawhide

Accuracy and Prompt Delivery

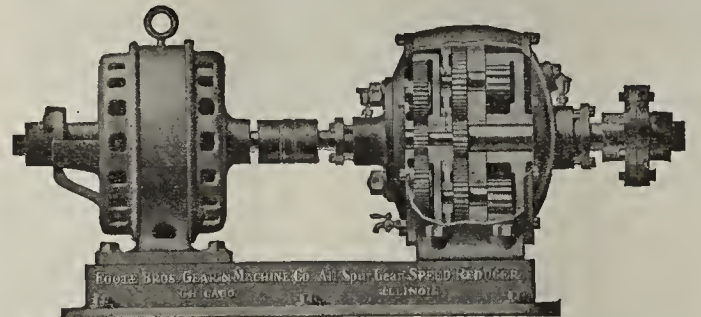
When you want a gear cut you want it quickly,—we emphasize our promptness without sacrificing accuracy.

Ganschow Cut Gears

stand first in accuracy—perfect mesh—silent operation and the quality that counts for long service.

Estimates furnished from drawings and specifications.
WRITE FOR CATALOG.

WILLIAM GANSCHOW CO.
1003 W. Washington St. - CHICAGO

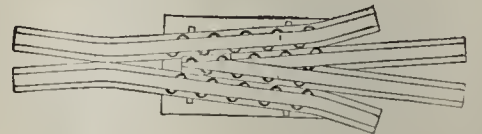


Where dust and dirt are thickest you will find Foote Speed Reducers giving continuous dependable performance. Foote Speed Reducers are made in types and sizes for all purposes. Consult us regarding your requirements.

FOOTE BROS. GEAR AND MACHINE CO.
228-238 N. Curtis St. Chicago, Ill., U. S. A.

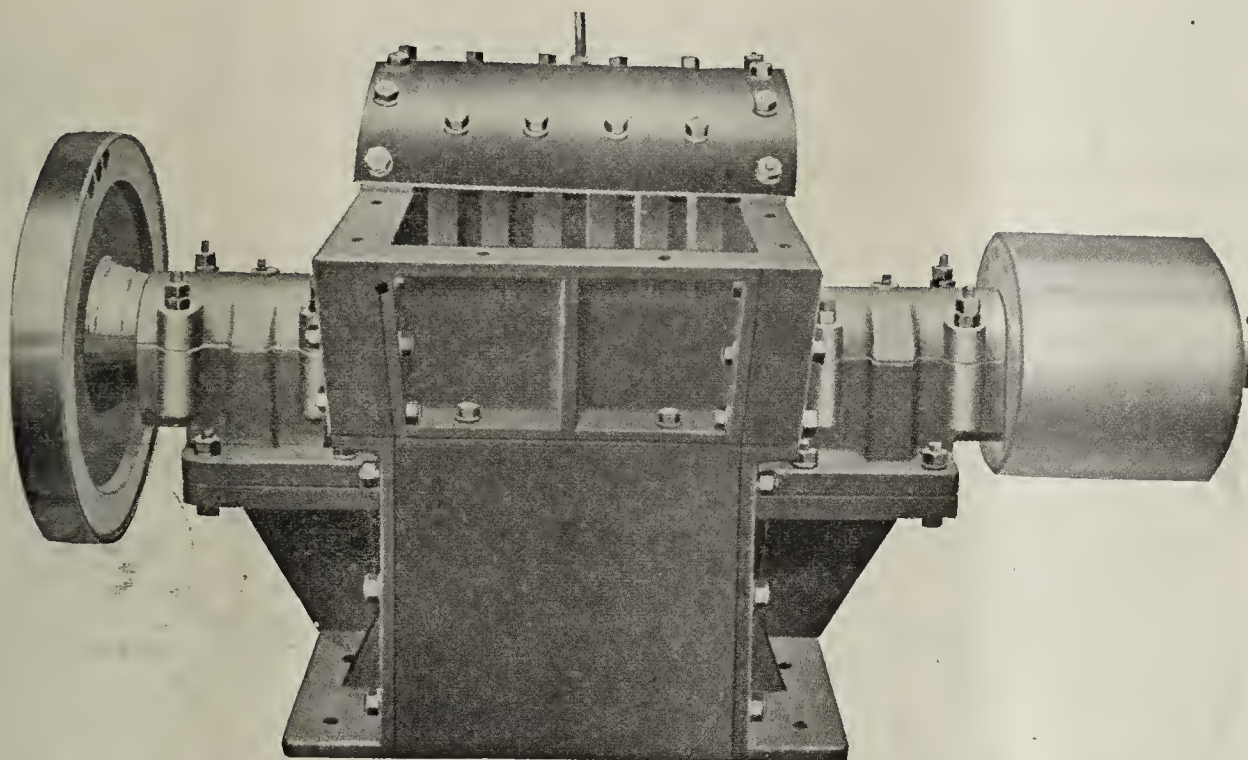
The "CINCINNATI" FROG AND SWITCH COMPANY

Established 1906
CINCINNATI, OHIO



Portable and Industrial Track

Frogs Switches Crossings
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GRUENDLER

Swing Hammer Pulverizer

For economical reduction of Gypsum, Marl, Clay, Shale, Tube Mill Feed, Limestone, etc., the GRUENDLER has demonstrated in plants everywhere that it delivers every expected service, is economical in operation, dependable and free from trouble. It gives complete satisfaction and assures a superior product.

Because of correct design, good materials and superior construction—with extra strength, simplicity and the correct principles upon which it is based—the GRUENDLER affords greatest capacity with lowest horse-power requirement and minimum maintenance expense. It is built in various sizes to meet every need.

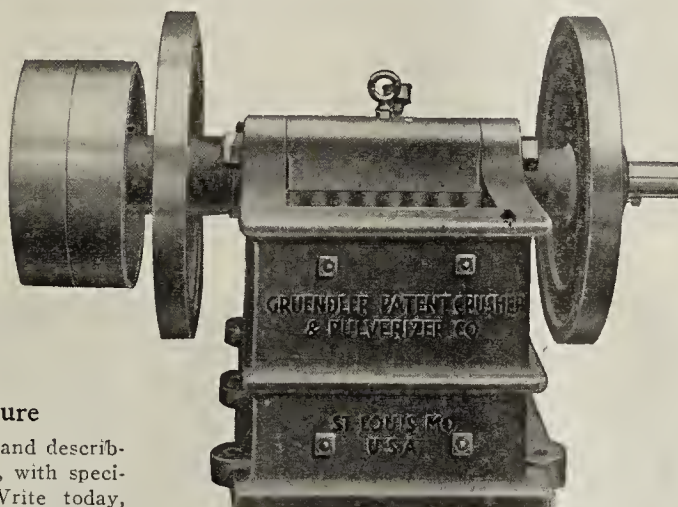
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Gruendler Crusher Heavy Duty Jaw Type

For products requiring a jaw-crusher, the GRUENDLER will be found adequate to meet every test and demand for efficiency, dependability, durability and freedom from breakdowns. All parts are accessible for renewal or adjustment, while the power requirement is less than for any other crusher of equal rated capacity.

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Let us send you our bulletins, illustrating and describing GRUENDLER GRINDERS in detail, with specifications, prices and full particulars. Write today, giving some information as to probable requirements.

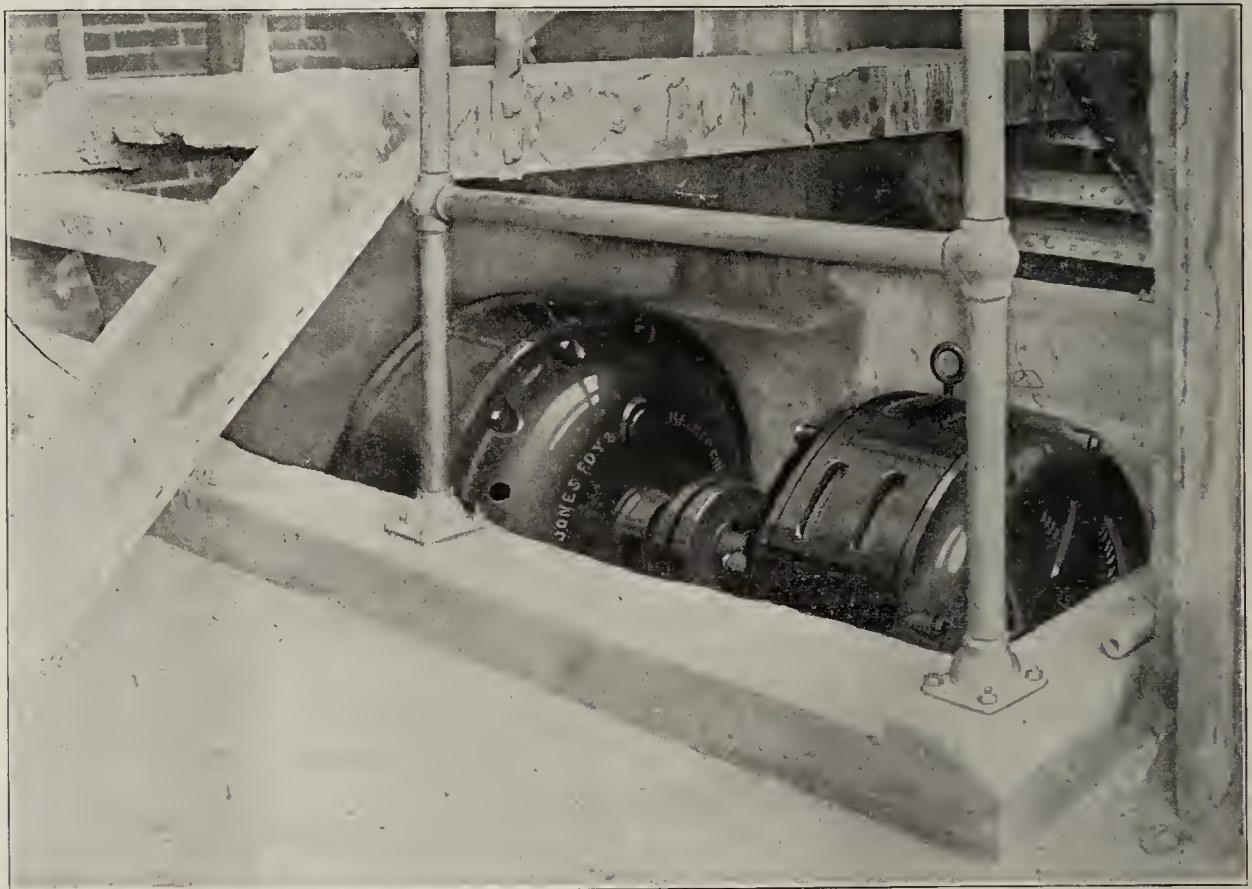


Gruendler Patent Crusher & Pulverizer Co.

991 Main St., St. Louis, Mo.

Cement Mill Dust Holds No Terrors for Jones Spur Gear Speed Reducers

They are not only dust proof, but they insure a maximum delivery of power at a speed as uniform and positive as that of the driving motor, and they economize space to such an extent that they can be placed where other forms of drive would be out of the question.



The above photograph was taken in the mills of the Western States Portland Cement Co. at Independence, Kansas, where eight Jones Speed Reducers are rendering satisfactory service. If they can do this for these critical buyers, they surely can do so for you.

Write for descriptive bulletin. Our engineers are specialists in their line and will gladly render you any advice or service possible

W.A. JONES

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Cast Iron Pulleys, Gears of all kinds, Pillow Blocks, Lemley Friction Clutches, and General Power Trans-		
missions.		
CHICAGO	Established 1890	NEW YORK
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Tarpaulins Save more than they cost!

In these days it isn't entirely a question of how much it will cost to replace worn-out equipment. It's more a question of whether or not you can get new equipment at all. It's therefore doubly essential that you take proper care of those machines you are now fortunate enough to have.

Plain and waterproof covers for all purposes. New and second-hand tents for sale or rent.

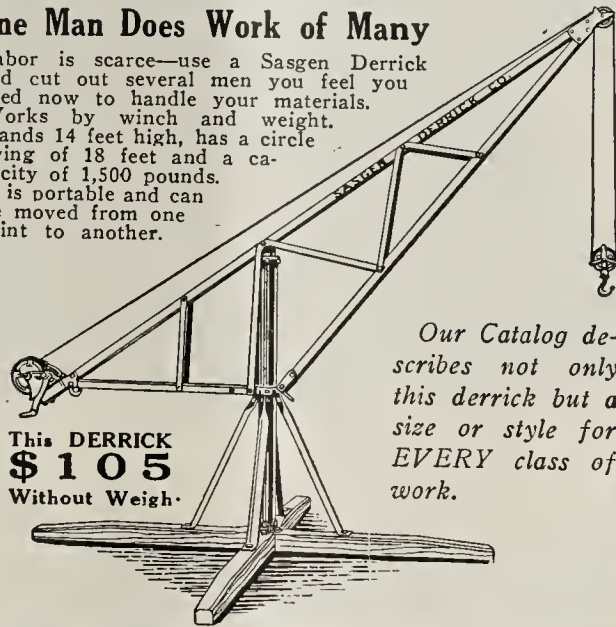
United States Tent & Awning Co.
217-231 No. Desplains St. Chicago, Ill.

Load and Unload With a Sasgen Portable Derrick

The Sasgen Circle Swing Counterweight Derrick cuts costs, labor and time loading or unloading material from cars or wagons.

One Man Does Work of Many

Labor is scarce—use a Sasgen Derrick and cut out several men you feel you need now to handle your materials. Works by winch and weight. Stands 14 feet high, has a circle swing of 18 feet and a capacity of 1,500 pounds. It is portable and can be moved from one point to another.



This DERRICK
\$105
Without Weigh.

Our Catalog describes not only this derrick but a size or style for EVERY class of work.

Sasgen Derrick Co., 3117 W. Grand Ave., Chicago

Safe Scaffolding—Up Quick!!

Three seconds!—and this bracket is up—safe and sure. No nailing, no slipping over the top of or cutting into the upright, no tightening of bolts. Simply applied to any part of the upright. The teeth on the dog plate grip like a bull dog—the heavier the load, the tighter the grip. These are the brackets you've waited for, MR. MASON CONTRACTOR.

Johnson Safety Patented Scaffold Bracket

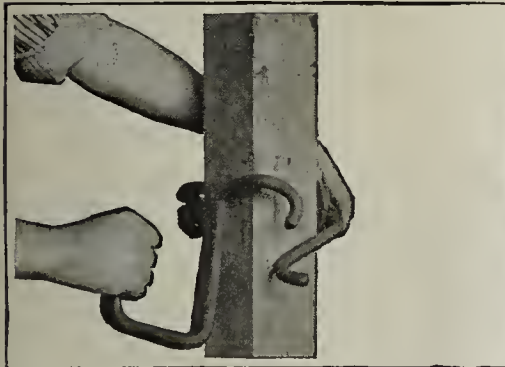
Positively durable—made of 5/8" mild steel. All in one piece—no losing of parts. A labor and money saver on all types of masonry work, stuccoing, etc. Inexpensive—pay their cost on the first job—then pay you!

Write NOW—for Price on a Trial Dozen

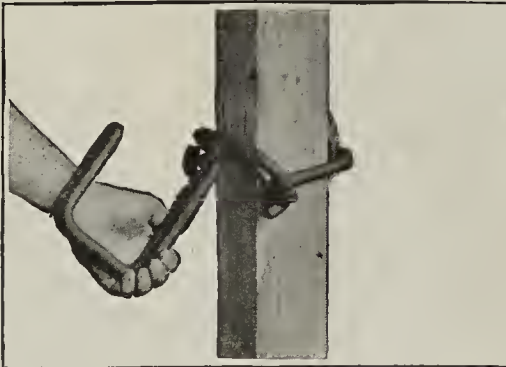
You can't afford to turn a cold shoulder to a money-maker. Try a sample dozen. You'll wonder how you ever got along without them. Write right away for prices.

We also can supply a better pudlog iron.

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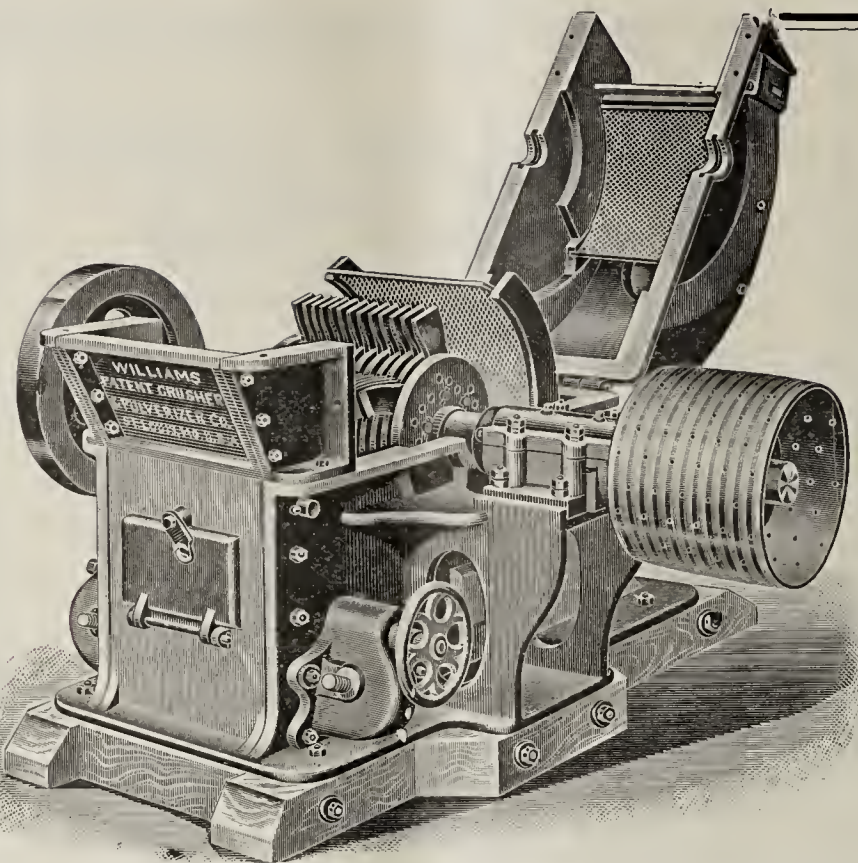
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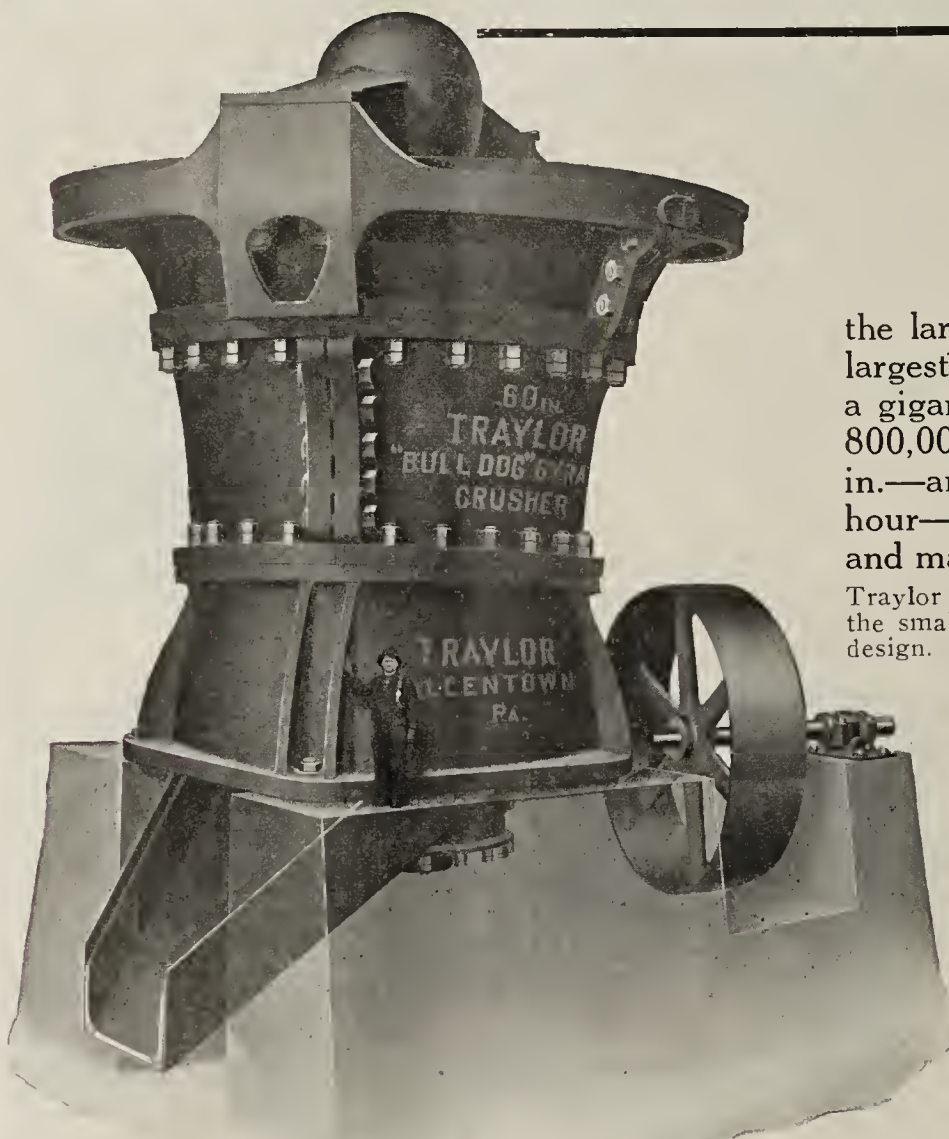
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the largest crusher in the world, built for the largest producers of flux stone in the world—a gigantic "Bulldog" Gyratory weighing over 800,000 lbs.—receiving openings 60 in. x 190 in.—and a capacity of 2500 to 3000 tons per hour—truly an achievement in crusher design and manufacture.

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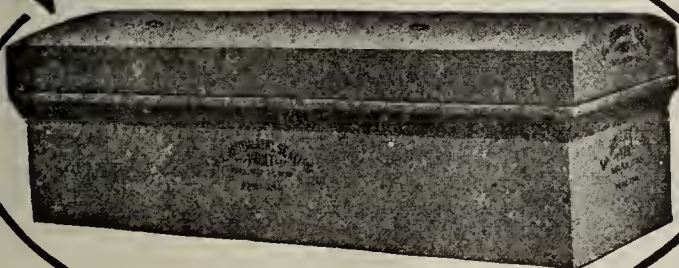
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The Chain that puts the SHOVE
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EQUIPMENT ON THE MARKET.

The Aero Pulverizer is a complete pulverized coal plant in one machine.

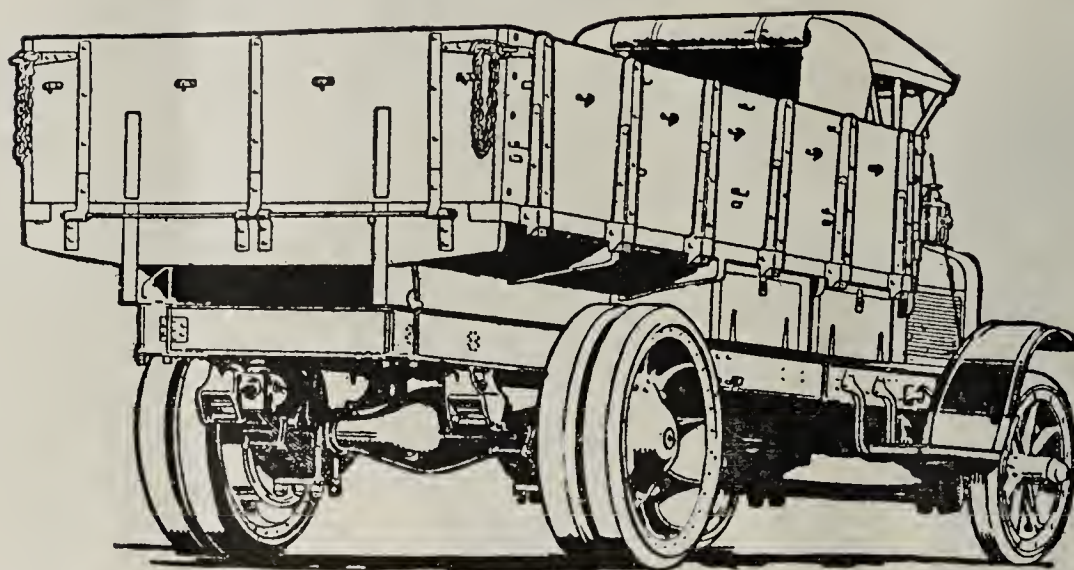
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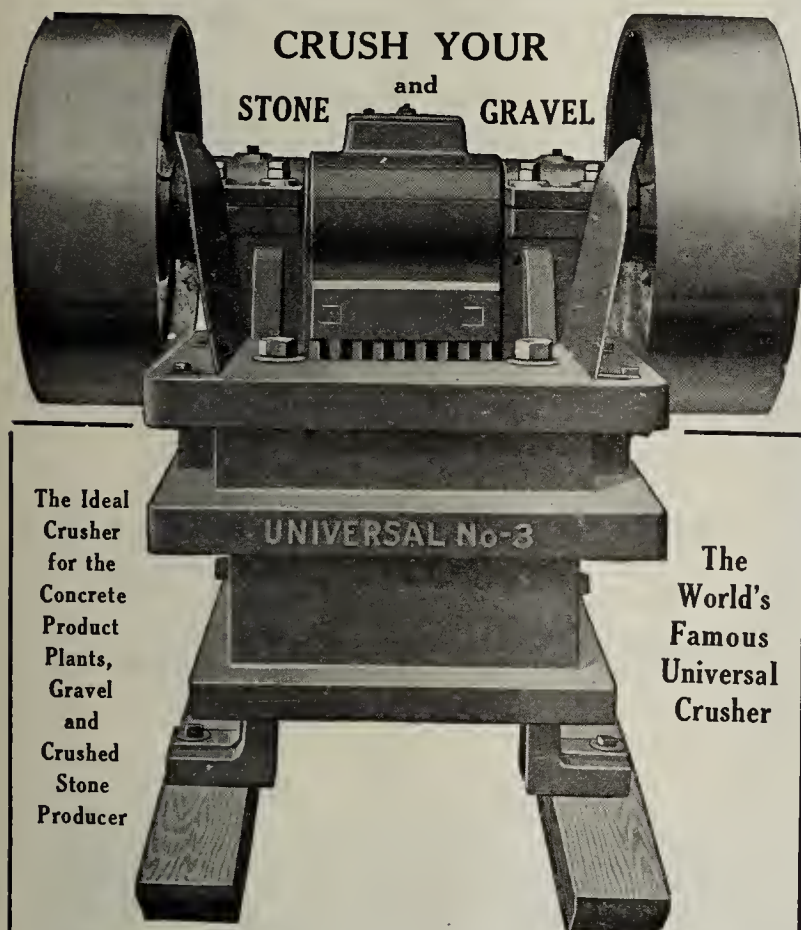
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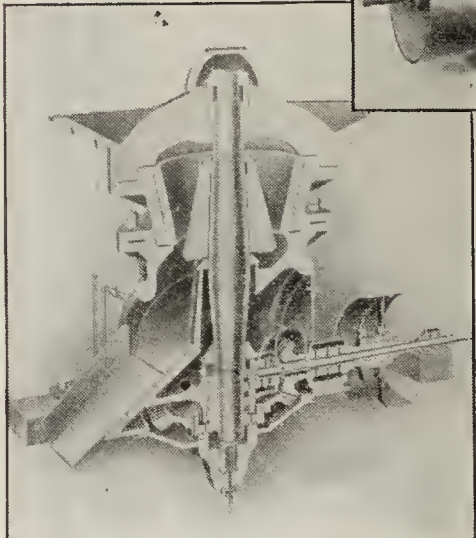
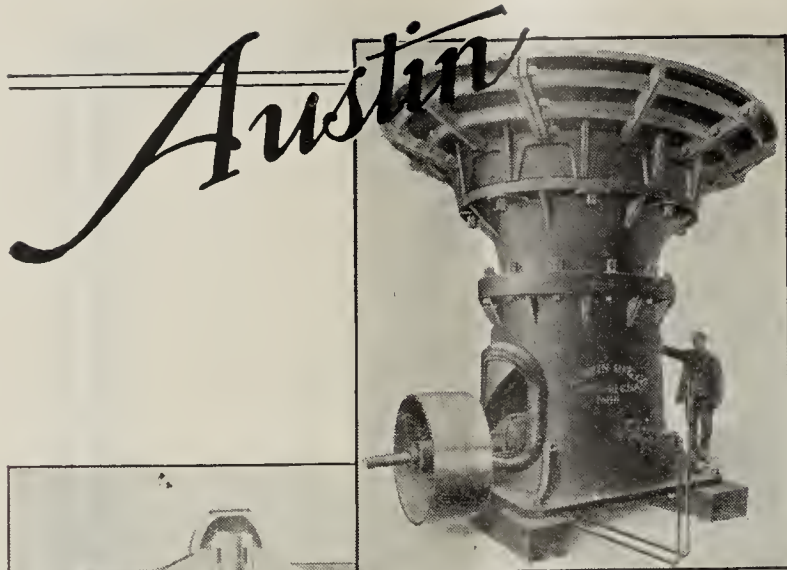
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Without Rotary Kilns the quantity production of cement and the roasting or nodulizing of ores on a commercial scale would never have been possible.

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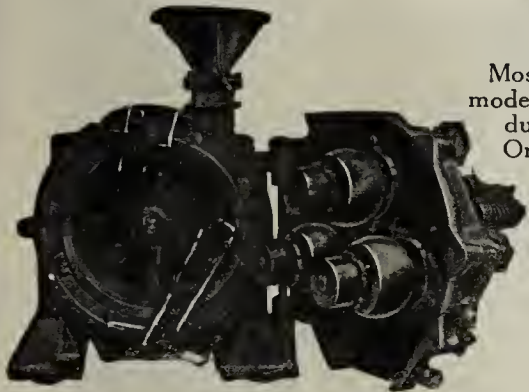
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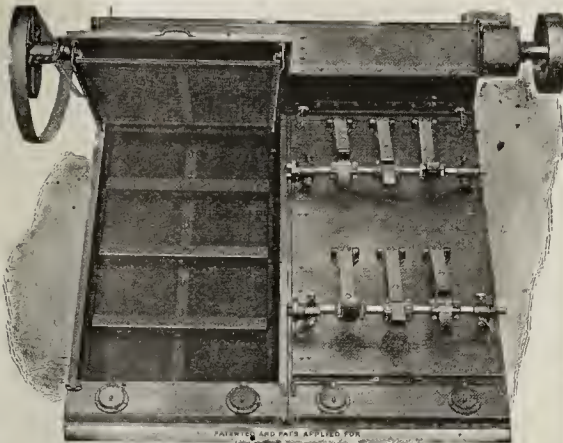
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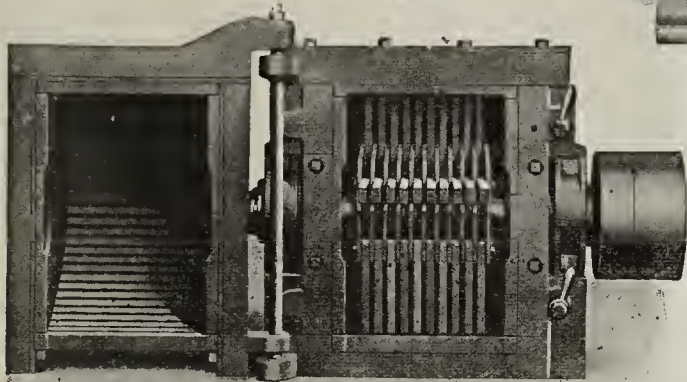


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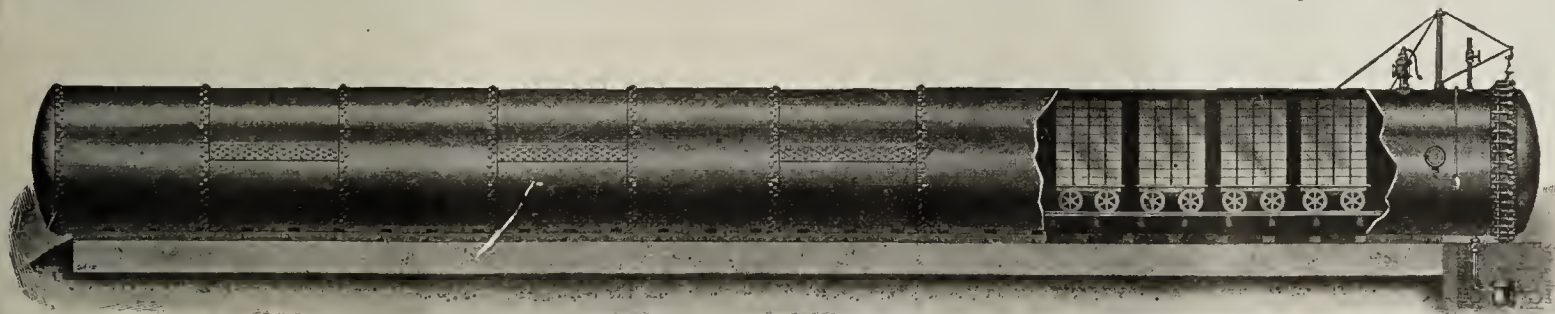
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Sand Lime Brick Machinery

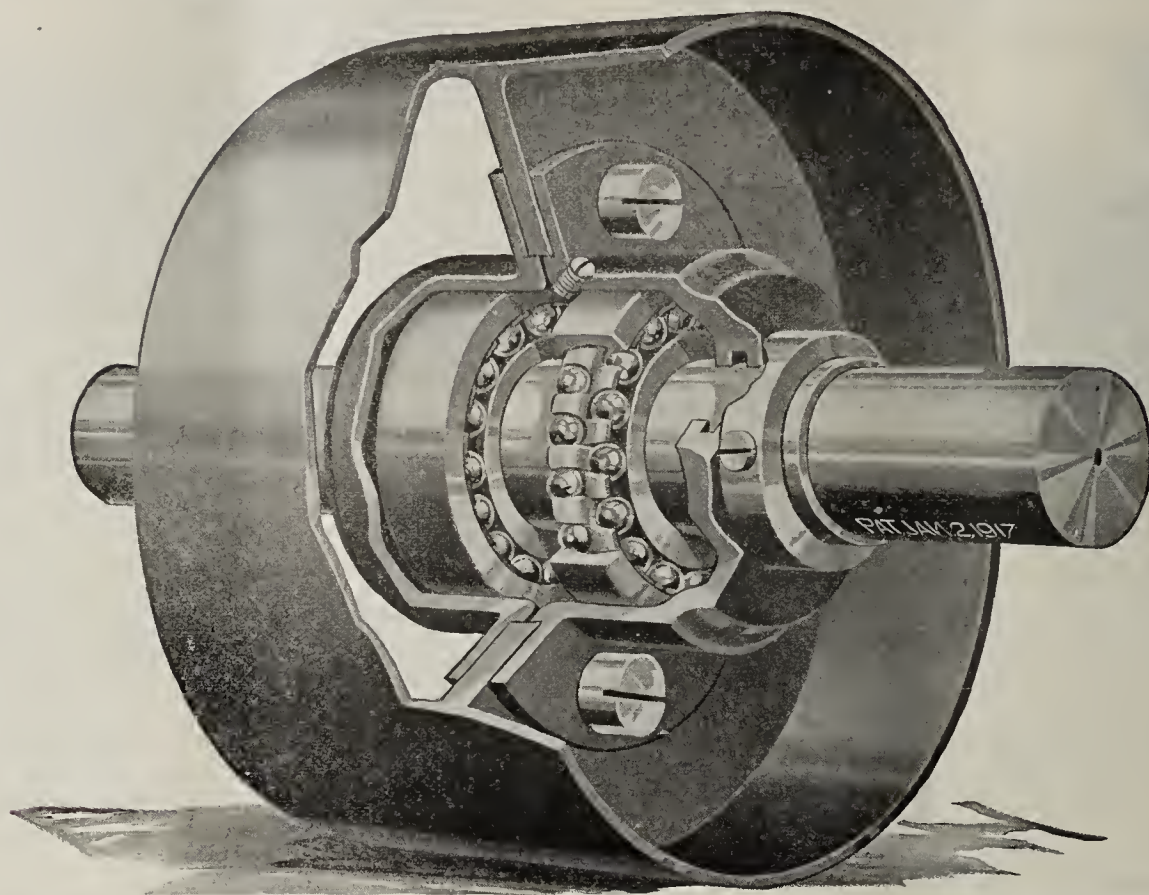
Our complete line of Sand Lime Brick Machinery makes it possible to secure just that machinery which is required to make your plant a success. We favor no particular type of machinery but are guided by the needs of the customer. Our wet and dry grinding mills have transformed a number of unsuccessful plants into dividend producers, while our Presses, Mixers, Hardening Cylinders and other equipment are of equal quality. We can exactly meet the demands of any manufacturer with a quality of machinery which will operate at a profit with a minimum amount of attention and expense.

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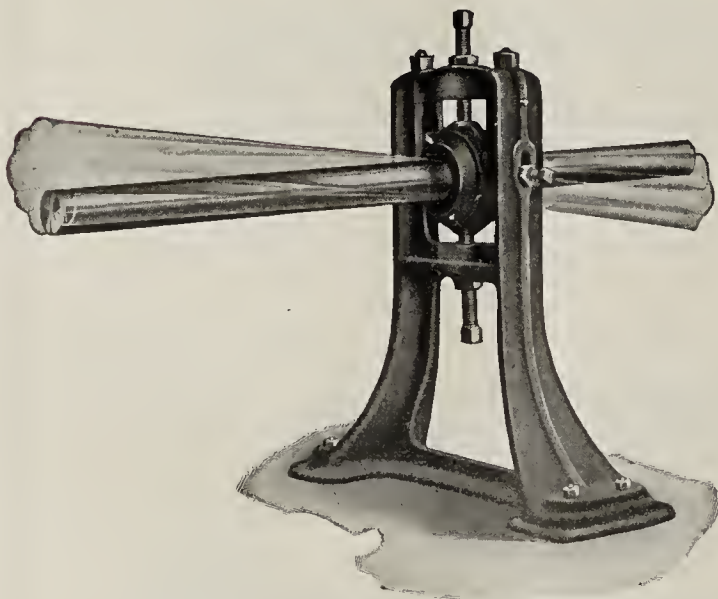
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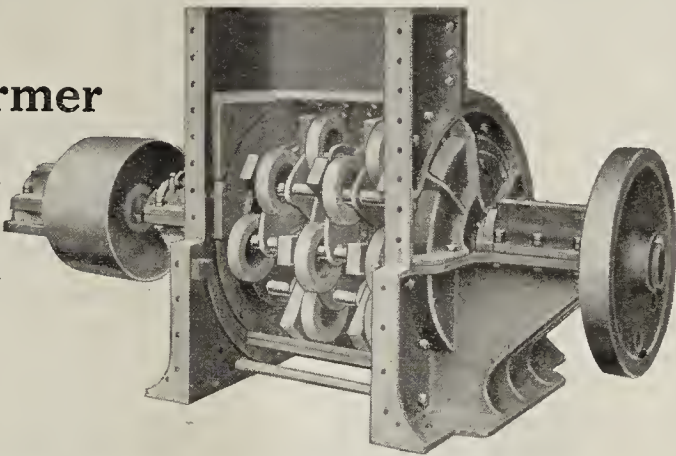
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Ring Pulverizers

are earning enormous profits for their users. The plant here shown paid five times its cost in profits in five months running. This is not an isolated instance. Many others have done equally well or better in producing

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The profits are large; the market far bigger than the supply. Install a guaranteed machine—An American Ring Pulverizer.



It's guaranteed. Cost of production is but 15 to 30 cents per ton when an American is used.

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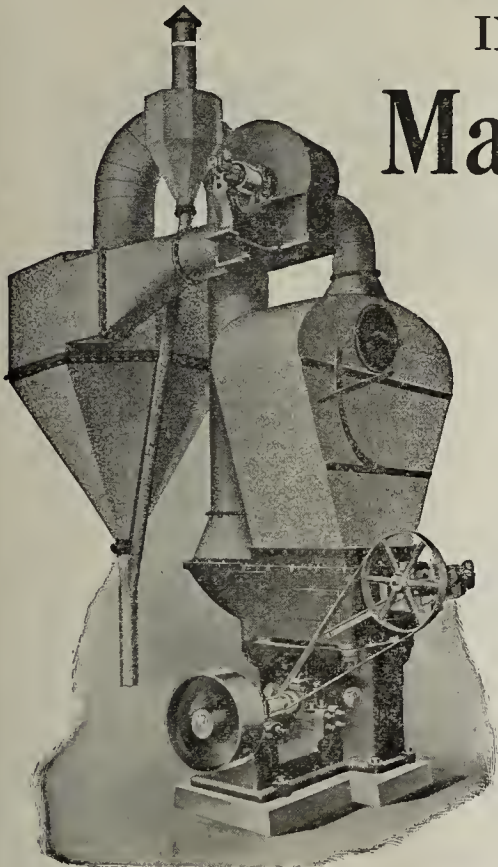
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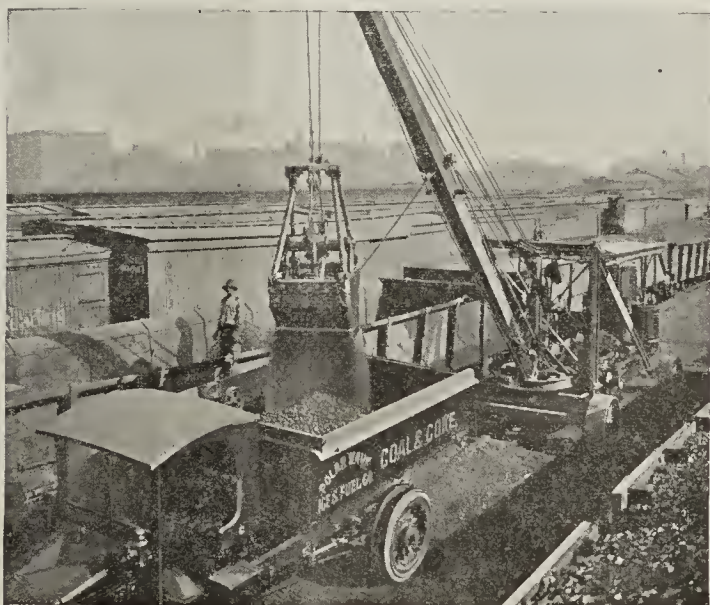
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Problems up to a

BYERS AUTO-CRANE

Ask for BULLETIN 1015 Showing a Variety of Uses



Steam, Gasoline or Electric Power
Road Wheels, Rail Trucks or Caterpillars

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RAVENNA, OHIO

The Bradley Hercules Mill

In September another large cement company adopted this mill as a preliminary pulverizer, and another Lehigh Valley cement company started operation of installation.

Investigation means purchasing, as no other mill has ever equaled this mill's performance as to low horse power consumption, low maintenance cost and large output with an extremely fine product that increases the output of any tube mill.

It's a Great Labor and Money Saver

Let us send our engineer to show how these mills will fit in with your present tube mill installation and reduce your cost of manufacture and relieve your labor situation.

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Manufacturers of the Giant Griffin Mill

BULL FROG Wheelbarrows

**The Only Come-Back
Is — FOR MORE**



We manufacture with this idea only in view
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Cement and Engineering News

Vol. 31

Chicago, October, 1919

No. 10

Ravings of a Modern Cyclone

By D. C. Steadman



started out to put to rout a bunch of Kansas counties; I felt the need, I did indeed, of picking up some bounties. "Forget your soup and fly the coop," I thundered at the people; "Your life's at stake, I'll leave a wake and spare no farm nor steeple." I picked up pigs and ancient rigs, I juggled Fords and Saxons; I sure raised hell, and did it well, by blowing all the Klaxons. Uprooted trees sailed on the breeze, while houses took a flyer; barns went larking, dogs a-bark-



ing, mounting high and higher. 'Twas sure a snap to change the map where wooden structures stood; but let me say, I've had my day—gone is the reign of wood. I do not know why all my blow should fail to leave a trace of passing harm, or e'en alarm, on concrete's haughty face. Gibraltar's rock could stand no shock more nobly, I am sure; the essence of worth and grit of earth have made concrete endure. And so, you see, they've made of me a baby weak as wood, they swiped my thunder so my plunder would not be so good. I ripped that town quite upside down, but concrete stood the gaff, while other stuff that was not tough I tossed around like chaff. Young farmer Brown of great renown no cyclone cellar had, he was not there, so in despair I hunted up his Dad. I could not scent the poor old gent to take him for a spin, so picked the farm upon my arm, hoping both were in. They put it over, yes, by clover! all the Browns got by, while Jersey stocks and Plymouth Rocks went sailing through the sky. I sure am stuck and out of luck, I missed 'em by a mile-O; the whole blame bunch they took a hunch and hid in their concrete silo.

Editorial

Utah Leads in Concrete Pavement Yardage Per 100,000 of Population

Contracts awarded for concrete highway construction in Utah from January 1 to June 28, 1919, show that a total of 741,513 square yards has been let.

Although this yardage is not so great as that contracted for in a number of other states, it nevertheless has brought to Utah the distinction of having awarded, this year, the greatest concrete pavement yardage per 100,000 of population of any state in the Union. According to latest figures available, Utah's population is 373,351 and this gives to Utah 198,797 square yards of concrete pavement per 100,000 population.

A number of other highway paving projects in Utah are being promoted for concrete or are about to be placed under contract and before the end of the active letting season, the total yardage will be considerably increased, and it is expected that this will enable Utah to retain its present distinction.

Big Blast at Riverside

The Riverside-Portland Cement Company, Riverside, Calif., recently set off the biggest charge of nitroglycerine ever exploded at one time in Southern California, utilizing approximately 120,000 pounds, or 60 tons of the explosive. The charge was exploded by electricity, and the rising volume of cement rock, smoke and dust was recorded on moving picture films. For six months crews have been working into the mountain of limestone at the company's plant at Crestmore, near Riverside, and for two weeks four men have been placing the nitroglycerine in the holes drilled at intervals along the 500-foot of tunnel. It is estimated that between 125,000 and 135,000 cubic yards of material were dislodged and rendered available for the crushers at the mill, which will probably have sufficient limestone available to keep it supplied for a year. The mountain side to a height of 160 feet and for a distance of 900 feet was shattered by the explosion, which was successful from every standpoint.

Concrete at Industrial Plants

Years ago when there was plenty of timber and steel in the country, concrete was not very generally used for construction work at industrial plants. At that time concrete was used for foundations, heavy walls above ground and a few simple structures.

This condition has been entirely changed. Nearly every needed industrial structure can now be built of reinforced concrete. Scarcity of timber and high cost of steel influenced the initial changes in structural materials. However since these changes have become effective concrete has proven its superiority over all of the other building materials. Concrete has been given its chance in industrial plant construction and has made good. However, these facts are not generally known by contractors or industrial plant executives. Even many men actively engaged in the advancement of concrete construction in other fields are not aware

of the present uses of concrete about the factory. In fact, it is impossible to understand and follow the rapid developments unless a thorough survey of industrial plant construction is made.

The leading cement manufacturers of the United States and the Portland Cement Manufacturers Association, through their technical departments have made a general survey of this kind and are now prepared to advise contractors regarding concrete in industrial plant construction.

A wonderfully valuable book on reinforced concrete in factory construction has been written by that well known consulting engineer, Mr. Sanford E. Thompson, and issued by the Atlas Cement Co., of New York, and should be in the hands of every contractor whose work carries him into the industrial field.

This vastly interesting subject is well handled in every detail from the construction of the foundation of a factory building to the correct design of roofs for buildings of this type.

A copy of this book should be in the hands of every factory executive in your territory who is a prospective erector of new industrial buildings. The Atlas Portland Cement Co., New York and Chicago, shall be pleased to send you a sufficient number of copies to cover your list.

Pratts' Shippers' Record Book

Clarence F. Pratt, President of the Pratt Building Material Company, Hearst Building, San Francisco, has just published a three hundred page record book entitled "Pratts' Labor Saving Freight Paid and Shippers' Record Book with Recapitulations."

There are nine specially ruled sections as follows: "Freight Paid and Other Information on Carload Shipments Only"; "Charges Paid on Less Than Carload, Steamship, Motor Freight, Stage and Express"; "Claims Record Against Railroad, Steamship, Express, Motor Freight and Stage Companies"; "Record of Carload Shipments—Loading, Unloading, Demurrage and Car Movements"; "Recapitulation of Freight Paid and Other Information on Carload Shipments Only"; "Recapitulation of Charges Paid on Less Than Carload, Steamship, Express, Motor Freight, and Stage Companies"; "Freight, Express and Other Rates Quoted by Transportation Companies, Traffic Managers, Transportation Experts and Our Own Traffic Department"; and "Names, Titles, Addresses of Officials of Railroad, Steamship, Motor Freight, Stage or Other Transportation Companies."

Mr. Pratt has had a great deal of experience in shipping and paying of freight to railroads, steamship companies, etc., as his new book indicates. The book has met with instant favor among traffic men, railroad officials and shippers, both large and small.

The record book contains many suggestions from officials of, and copies of forms used by the Standard Oil Company, The Railroad Commission of California, the Southern Pacific Railroad Company, the Atchison, Topeka & Santa Fe Railway Company, as well as several transportation experts.

Copies of this book can be obtained from the stationery stores or from the publisher.

Subject of Accounting as Applied to the General Contractor*

By L. A. Weatherwax

There is perhaps no one subject to be considered during the so-called reconstruction period deserving of more careful and conscientious study than that of "Accounting" as applied to the details of the business of the general contractor. We have—all of us—evolved some system whereby we are able to say after a project is complete whether we have made or lost money. Some of us doing the larger class of work employ bookkeepers to give us this information. We are more concerned with the successful completion of some difficult piece of construction than we are with minor debits and credits—we feel secure in the fact that we employing trained men to keep our books and consequently get out of touch with the many intimate details of the business. Others of us follow the old idea that whatever is left in the right hand trousers pocket when the job is complete and all the bills paid represents the profit on the work. Still others of us take perhaps too much interest in the small details that had better be left to an employee and in that way lose sight of far more important subjects in a mass of detail. A happy combination of the three types would make for better office administration.

I venture to say that of the contractors present no two have the same method of accounting, one man has a very pretty double-entry system that nobody can understand except the man who keeps the books, while the next man has his books on the back of an envelope in his inside pocket—the third man don't keep any books at all. This wide divergence in the matter of accounting, together with a similar lack of co-ordination in the matter of estimating and cost-keeping, is responsible, in great measure, for the wide divergence noted at almost every opening of bids. It is partially responsible for the feeling of distrust engendered in the minds of the banker and bondsman—the very people without whom we cannot do business, be it large or small—when we go to them for a legitimate business loan or require a bond. A wide difference in the method or rather lack of method in accounting, estimating and cost-keeping is again responsible for the feeling in the mind of the general public that the extremely low bid is the correct bid and all the other bidders are robbers. We must also combat the idea in the public mind that was originally conceived in the mind of the cartoonist—that of the contractor with his pockets stuffed full of juicy contracts—a wide expanse of vest—big, fat, jolly, rolling in opulence. Gentlemen, we are distrusted by everybody—our banker thinks we are gambling—our bondsman thinks we are padding our assets and the architect and owner think we are combined to take excessive profits from our work, when as a general rule when we go to our banker for a loan, it is in most cases a legitimate requirement of our business. When we make application for a bond, we are generally entitled to instant consideration, our ratio of assets to liabilities is a proper one, and as far as collusion goes in the matter of bidding, we all know we would at least keep from writing losses into our contracts if we could only trust each other and get together in an attempt to arrive at a fair and reasonable price for our work.

You hear the word reconstruction applied to every conceivable subject these days until perhaps the real significance is lost to us as individuals—we think of it as that intangible Aladdin's Lamp, the very touch of which will make things right again and forget that we as individuals and as a class are just as much in

need of a thorough sweeping away of the accumulated cobwebs of years as the other fellow or the other business, and one of the prime requisites towards stabilizing our business and acquiring our "Place in the Sun" is that very thing—an almost imperative need for more similarity in our method of doing business and by similarity I do not mean that our individuality shall be submerged in a set of stock rules and regulations governing our associations among ourselves and with the public at large.

For our own good as well as a means of raising us in the estimation of our fellow citizens let us devise some general scheme of accounting which will at once be capable of expansion to care for the needs of the largest operator as well as for the man whose limited capital necessitates the accepting of smaller contracts. With two or three exceptions we are all operating on a capital invested of not to exceed a hundred thousand dollars and it should not be a serious matter to devise some standard guide by which we could all work, varying details to suit our individual requirements, and the time is not far distant when either we shall have to take steps towards some such standard form of accounting or our government will do it for us.

We are facing at least several years of high income taxes, capital stock taxes, surplus profits taxes, and the host of other necessary governmental taxes collected from us directly instead of indirectly as heretofore. These taxes are collectable at stated intervals, the returns must be made by a certain day or we get a neat little message from the internal revenue office to the effect that they will consider a check for ten dollars or a hundred dollars as an offer of settlement by reason of our failure to make the return within the required time. I think perhaps many of you have had that same experience. Other businesses are able to make their returns on time, why not us—merely because we have not paid enough attention to the accounting end of our business. Do you know that the lumbermen spent some hundreds of thousands of dollars in an effort to standardize their accounting and cost records so that they could "account" to the Government for every item entering into the manufacture of lumber of all grades and thus convince the Government that they were not profiteering? You have noted that lumber prices have been pretty much the same as between different mills. It is not because they have gotten together and said that such and such a price shall be charged, but primarily because they have a standard system of cost-keeping and accounting which shows them that it is costing them approximately the same to manufacture and market their product—allowing of course for rail facilities, stock on hand, etc. They have found that some such system was absolutely necessary in order that they might put themselves right with the public—and some such system is just as urgently needed by the contractor for his business.

Then again we are harassed periodically by the State in the collection and reporting of contributions to the industrial insurance and medical aid funds, while in States having no such laws we are forced to carry liability insurance, our pay-rolls subject at stated intervals to audit by State or private officials. A five minutes' talk with one of the auditors for the State Industrial Insurance Commission would convince you that the contractor, generally speaking, has very little idea of accounting. The very provisions of the laws as regards the percentage of contribution are supposedly based upon the percentage of accident in the

*Paper delivered before Northwest Master Builders Convention at Seattle.

different trades employed in the construction of a building, consequently we are required to make at least some segregation of our payrolls, at least as between laborers, carpenters, roofers, painters, etc., each of whom have different accident ratios, consequently different premium rates per dollar. Some of us have a daily report system, very complete and also very costly—kept by the foreman who in the rush on the job generally forgets all about the report until night—then puts down something to satisfy the office—sometimes correct, but oftentimes not. On large operations justifying the employment of time clerk and cost clerk combined the tendency is to go into too much detail and swamp the “accounting” office with a mass of detail and costs which are carefully worked up and then forgotten. It is not the purpose of my talk this evening to go into the subject of cost-keeping except to point out that as regards labor costs, the States are making it necessary for us to keep such records more or less carefully segregated and the time is coming when the State will demand more uniformity in the matter of keeping the records of the different branches of labor employed by us.

The very fact that our fellow citizens as well as our Government and our State have a financial interest in our business in the collection and reporting of various forms of tax should bring to each of us the necessity for a general similarity in our methods of keeping our accounts—at the same time we each have our pet method which to us may answer admirably the requirements of our business, but when the Government or State comes around and asks for certain financial reports there is a wild scrambling, burning of midnight oil, etc., in a desperate effort to pick out from our accounts the information needed. We each of us may be satisfied that our system is the best one and perhaps it is, but our colleagues have no knowledge of it, so no one is benefitted but ourselves, and following that rule of “The greatest good for the greatest number” we should be glad to confer with one another in an effort to assemble all available information on the subject, sift it, correlate it, reject here, add there, and finally evolve a standard system which, while it may not exactly fit your business without minor changes, will on the whole have the advantage of uniformity, enable our banker to say at a glance that we are entitled to that loan, our bondsman to say “Yes, we’ll write that bond,” and the dear old public to feel that the term contractor is synonymous with business honor, integrity, and confidence in the same way the merchant, the banker or plain business man is spoken of and thought of.

Periodically we are asked by Dun or Bradstreet to furnish them with a statement of our assets and liabilities, generally accompanying the request with one of their printed forms which those of you who have had the experience will know is adapted to the ordinary manufacturer, merchant—any business but that of the general contractor. We wrestle with their form and finally give them something to satisfy them, either on their form or one we have pounded out in haste for ourselves. The result is generally not very illuminating either to them or to us, and leads us into a false sense of financial values.

The same is true of many banks. When a customer goes to his banker for a loan, unless he has adequate collateral, the first thing requested of him as a prerequisite to any consideration of his application for accommodation is a financial statement showing in tabulated form his net worth. All of us use or should

use our bank as our financial adviser and counsellor, and in the line of credit allowed us by our bank we find an answer to what our bank thinks of us as financial risks. We all know that banks generally are not overly anxious for the contractor’s business for several reasons. The average contractor by the very nature of his business cannot keep large average balances. He makes relatively few deposits and writes hundreds of checks, making work for the bank’s bookkeepers, on top of this the very nature of his business again tends toward unconscious inflation of his net worth, especially where several operations dovetail one into the other. We must make our banker our confidant, must instill a feeling of confidence in him, and one of the first ways of establishing such relations is by means of a monthly balance sheet, using care to see that for comparative purposes it is always on the same form, and for the betterment of the profession as a whole why is it not logical to devise a standard form of balance sheet for the use of all contractors? Such a form could easily be prepared when the monthly trial balance is taken and should the contractors as a class voluntarily on the first of each month mail to their bank and to their bondsman a copy of their balance sheet it would go a long way towards procuring for us as a whole the good will and confidence of the very people we must conciliate, to say nothing of the great good to our credit among supply houses who universally use the services of Dun and Bradstreet in an effort to keep a line on the financial responsibility of the general contractor.

So you see, gentlemen, we cannot do without a more or less complete system of accounting—some system whereby, primarily, we ourselves are enabled to know as nearly as may be just what condition our business is in—a system that will really show to the bondsman—the banker—Dun and Bradstreet—the Government—the State—and, in fact, every one to whom we are required to furnish such information, that our business is carried on a firm financial foundation, entitling us to the courteous consideration accorded other businesses. Let us as members of an association comprising the Northwestern States devise a standard payroll sheet, preferably loose leaf, which will provide for medical aid and insurance tabulations as well as private cost records, bond reconciliations, etc. Let us devise a check register for handling our general account, which will enable us to segregate our payments to the different operations without the necessity of first running all accounts through a bulky journal. Let us devise a uniform balance sheet to be used for the information of those entitled to have such information. Then let us all use them, go to our bank and our bondsmen and say: Gentlemen, hereafter you will receive a copy of our balance sheet each month on this form that you may know as well as we just what our business is doing.

I cannot hammer home too strongly the fact that as a class we are considered shaky financially, and if we are to make these people know that we are substantial we must take steps to convince them that we are going to do business along proper lines, and what better way than to be able to say that we, too, have had our “house cleaning”—that we, too, by our very determination, are going to demand that we be considered as business men and then back up our assertion with vital information in the proper place. In this way, gentlemen, will we pave the way for better business, better credit and better associations with those upon whom we are dependent.

Prices, Supply of and Demand for Sand and Gravel

Sand and gravel are both formed through the attrition of rock by natural forces, the former having less than one-fourth inch diameter, while the latter has one-fourth inch and more. The loss of feldspar and ferromagnesium metal through finer disintegration causes sand to weigh less than gravel, the estimated weight per cubic yard being 2,665 and 2,820 pounds, respectively. Natural deposits of both are plentiful but vary appreciably in quality and size. The nature of the source of both sand and gravel has much influence upon the organization of the industry.

Not until recently has the production of sand and gravel emerged from its period of experimentation into a recognized industry. The process of production has gradually evolved from hand labor to the use of railroad cranes, dredge boats and washer plants. Unlike cement, which has but approximately 113 domestic producers, this industry has innumerable producers, varying greatly in capacity. The shipping radius, limited to approximately 50 miles by heavy freight charges, has restrained centralization. The leaders of the industry, through improved methods of production, uniform and accurate accounting systems, local and national organizations, have brought about a considerable degree of uniformity in the production of sand and gravel.

The total production of sand and gravel increased from 10,679,728 short tons, valued at \$5,748,099, in 1914, to 79,555,849 tons worth \$24,217,508, in 1913. Because of business depression in 1914, production dropped 274,114 tons below 1913. The 1915 production rose 321,568 tons above the previous year. Building operations in 52 leading cities were estimated at \$673,220,625 in 1913, \$619,732,354 in 1914, \$641,769,199 in 1915, and \$785,148,149 in 1916, which was the highest point during the six-year period. The total expenditure on roads in 1916 was \$272,634,424, while in 1913 it was only \$187,524,193. As a result of the 1916 prosperity there was a total production of sand and gravel of 89,091,732 tons, according to the United States Geological Survey.¹ In 1917, however, production receded to 76,419,325 tons; but it had a value of 46.1 cents, or 12.7 cents per ton over the preceding year, even though the building operations amounted to only \$530,403,525. The increased value was caused by the rapidly advancing cost of production. The 1918 building operation in 135 leading cities were 41 per cent less than those in 1917. No total production figures have been obtained for 1918, but the general policy of emphasizing military requirements and curtailing all enterprise not directly a part of military preparation indicates a rapid decline in production.

The imports and exports of sand and gravel are of no great consequence. A very small quantity of French molding sand is imported. The imports, mostly building sand from Canada, which were \$172,257 in 1913, steadily decreased to \$87,144 in 1916, even though free from duty. Exports of sand and gravel, though valued at only \$225,642 in 1913, steadily advanced to \$619,414 in 1918, the increase being effected through Canada's wartime demand, which rose, respectively, from \$202,003 to \$599,876. The Canadian imports and exports were not regulated by the War Trade Board, no ocean tonnage being required. With but trifling exceptions, however, the exports to other

countries decreased as the gravity of the shipping situation increased.

The prices of sand and gravel are subject to local conditions of competition and cost of production. Sand and gravel do not compete with each other, but only with other materials, as gravel with crushed stone. There is, however, much competition among producers of sands and among producers of gravels. Improved methods of production by the use of machinery and storage have lessened the cost of production and made possible lower prices. In some cases depletion of a bank runs 20 per cent of cost, while in production of lake sand there is no royalty or depletion charge. In 1918 but few producers were operating at nearly full capacity. This situation, with the increasing costs, noticeably stimulated prices. In 1917 the Federal Trade Commission estimated that the 1918 cost would be 30 per cent more than in 1917; this estimate probably fell short of the facts, because of the rapid rise in wages and the additional expense of operating at partial capacity.

Price Fluctuations and Government Regulations

This industry was indirectly regulated during the latter part of 1918 by the ruling of the War Industries Board restricting building operations to the extent of repairs and additions up to \$2,500. The Price Fixing Committee of the same board by order of August 28, 1918, regulated the prices of sand and gravel for the period ending December 31, 1918, in the Metropolitan-Philadelphia district, to 55 cents and 95 cents per ton, respectively. The Railroad Administration, by its general order of May 25, 1918, increased the class rate on sand and gravel 25 per cent and the commodity rate 1 cent per ton.

With a few possible exceptions, the production of sands not used in making war materials decreased because of Government regulations, while prices advanced. Building sand, a constituent in plaster, mortar and concrete, suffered a loss from 25,397,383 short tons in 1913 to 22,921,426 in 1915, but reached its production peak in 1916 at 27,193,462 short tons. Glass sand, which is 98-99 per cent silica, is uncommon and commands a high price. Its production amounted to 791,800 tons in 1913 and 2,018,317 tons in 1916, responding to the same influences governing building sand.

Fire and furnace sand which served military purposes amounted to 419,061 tons in 1913 and increased steadily to 604,035 tons in 1917. Engine sand, being stimulated by war demands, had a steady rise from 1,033,450 tons in 1913 to 1,410,222 tons in 1917. The molding sand production of 3,563,583 tons in 1913 was augmented in 1916 by munition and mining machinery demands to 4,662,649 tons. This increase continued through 1918. The peak of gravel production was 39,212,858 tons in 1914, and thereafter it steadily decreased to 25,312,820 tons in 1917. After 1914 the decreased production was partly caused by the advancing wages, decreasing road construction and repairs, and the decline of building.

Cement Company Elects

At the annual stockholders' meeting of the Helderberg Cement Company, Albany, N. Y., the following were elected for the ensuing year: Directors, Robert C. Pruyn, Frederick W. Kelley, Thomas E. Murray, John S. McEwan, Frederic Pruyn, Nicholas F. Brady, Howard Van Renselaer, Peter McCabe, James C. Brady, William L. L. Peltz, Thomas I. Van Antwerp, Gardner B. Perry; inspectors of election, Walter W. Batchelder, Martin T. Nachtmann and Morris Swartz.

¹It is estimated by the secretary of the National Association of Sand and Gravel Producers, Mr. Sutton, that the 1916 total production amounted to 175,000,000 tons, while the 1918 production was estimated at about 40 per cent of normal, or an output of 70,000,000 tons. The Geological Survey figures do not include the output of large numbers of producers supplying strictly local markets.

Fundamentals of Uniform Cost Accounting System for the Concrete Pipe and Tile Industry

By G. A. Schonlau

It is the purpose of this article to outline the simplest, most labor-saving and most result-producing method of accounting for use in the manufacture of concrete pipe and tile.

Less than 20 per cent of the business concerns of this country have a cost accounting system! The Federal Trade Commission has called attention to this condition and has pointed out that a large proportion of the many failures recorded every year are due to the absence of an accurate knowledge of what it costs to manufacture and sell. Even the street faker selling shoestrings knows his costs, and to that extent is better posted about his insignificant business than the heads of some large enterprises. The Federal Trade Commission has urged every business man to take the steps necessary to learn his costs—in no other way can American business be brought to a proper degree of industrial preparedness.

Webner says: "The advantage that knowledge of production costs gives a manufacturer when making prices is easily seen. His prices are made intelligently. He can cut to the lowest possible figure when necessary without fear of incurring losses, or if the conditions justify a loss on certain lines, he will know exactly how far he can go without exceeding the justifiable and intended loss.

On the other hand, without a knowledge of costs, he is absolutely in the dark in fixing prices—so much so that his only safety lies in prices so high that he is absolutely sure he is above production cost—a happy-go-lucky method of pricing that while safe from the standpoint of direct loss, is not in this highly competitive age, conducive to large success."

This much is certain: Other things being equal, whoever bids lowest gets the business and the more frequently he is the lowest bidder the more he will get. If his prices admit a reasonable profit, well and good, but if he loses money on his prices he will sooner or later be obliged to liquidate and the length of life of his business will be in inverse ratio to his volume of unprofitable work.

Co-operation

In the past many manufacturers disliked to give out any information concerning their businesses. The old idea was to keep methods secret, on the general assumption that the things hidden from a competitor were the things that made us successful and big. The idea of overcoming competitors was to have so much capital that we were able to lose more money than the competitor could afford to lose. If anybody competed with us the process was to freeze him out by standing the loss longer than he.

Today, in most lines of industry, such destructive practices have been eliminated. Co-operation is more and more becoming the watchword. Trade associations are compiling statistics as to production, shipments, costs, etc., for the benefit of their members, and the manufacturer, instead of trying to keep this information to himself, welcomes the opportunity to supply the data, because he knows that his competitors are doing the same thing and that the statistics will be of benefit to himself and to his industry. The modern idea is to make the industry prosperous. The very purpose of this organization is co-operation and the exchange of ideas which may either promote the business or reduce costs.

The exchange of ideas is far more profitable than

the exchange of merchandise or money. If you have a dollar and I have a dollar and we exchange dollars, then we each have a dollar the same as before, but if you have an idea and I have an idea and we exchange ideas then we each have two ideas. Further, if there are 100 members of a trade organization and each had an idea which he puts in the general pool, then thereafter each member has 100 ideas.

Heretofore this thought has not been extended to the accounting practices of the manufacturers of concrete pipe and tile, but it is possible to reap the benefits of a practical application of the idea of co-operation in this respect by having uniform systems of accounting in the various plants.

Standardization

One of the objects in bringing the accounting feature of business before this convention is the urgent need in every industry of standardization of accounting practices. Most industries realize this need, some have taken steps to remedy it and a few have succeeded in establishing a degree of uniformity and standardization that is already proving the practicability of the plan. Of those who yet remain doubtful as to the possibility or practicability of applying a standard system of accounting for each industry, a marked majority feels that their own business is different and presents conditions not common to the other businesses of the industry, thus placing them beyond susceptibility to any plan of uniform accounting.

But uniformity or standardization in accounting practice does not require that each business in the industry be the same as all the others. On the contrary, it permits of unlimited variation. The element of uniformity applies only in principle and affects only those things that are common to the industry. It has no restricting influence whatever upon any of the uncommon features or unusual conditions with which any individual business may be concerned.

The prime objects of standardized accounting may be stated thus:

1. To create a common basis upon which each individual business can make an intelligent comparison of its own results with those of other businesses in the same industry.
2. To establish standards by which each individual business can, through comparison, determine its own degree of efficiency or inefficiency in each particular phase of its efforts.
3. To develop the best possible accounting practice for each individual business of the industry.

One essential to such uniformity is to make sure that the various accounting terms are applied with the same meaning by all. Without a common understanding of just what is meant by each term used and just what class of items are charged or credited to each account, intelligent comparisons are obviously impossible.

The next essential is to have a uniform or standard classification or list of accounts to make sure that each business in the industry uses the same account for like items, and that results and conclusions are arrived at in the same way by all.

Many businesses may require accounts that will not be used by any of the others, but this will in no way interfere with the uniformity idea. Some concerns will operate in their own building while others rent

or lease. Standardization would only require that the same method for applying housing expense be used, regardless of whether it be in the form of rent or the various items of expense incident to owning the property such as insurance, taxes, water, repairs, management, depreciation, interest or investment, etc.

Some concerns operate largely on borrowed capital while others may use little or no borrowed capital. Some charge interest on their own capital invested in the business while others charge interest only on the borrowed capital. Standardization simply requires that all apply such charges in the same way.

The logical conclusion is that standardization in accounting practice entails neither difficulties nor hardships, involves no new theories or radical changes, but presents possibilities for constructive co-operation and individual efficiency that would be utterly impossible without it. It is in line with the passing of destructive competition and it will greatly assist in firmly establishing co-operative efforts as the great constructive force in the improvement of trade conditions.

Of course, there should always be, and there always will be, healthy competition for business—but not destructive competition. And because of this fact, business men are recognizing the advantages and benefits if not the absolute necessity for practical co-operation in business and accounting matters.

The economic value of the plan supplies driving force which will surely bring—soon we hope—the time when every manufacturer of concrete pipe and tile will have before him definite figures compiled from reports of all manufacturers in his line, showing such essential details as the average cost of doing business, the average gross and net profit and the average yearly turnover, just as every insurance man now has the tables of comparative risks and rates based on the experience of all companies in the field.

What would it not be worth to every manufacturer to be able to compare his figures of actual results, item by item, with the average figure of others in the same line of business?

Who can say how many business failures with their attendant waste could be eliminated each month and year through the use of such an automatic danger signal?

And who can say to what extent the business that now struggles for existence with destructive practices purely through lack of definite knowledge of existing conditions, will be enabled to see the light to the positive betterment of itself and of the industry as a whole?

Knowledge of Costs Essential in Price-Making

The purpose of conducting a business is to make money, and the only way to make is to sell something for more than it costs.

A reliable system of cost and financial accounting will record where every item of material and time and expense goes in the making of a product or in the process of buying and selling goods. No one will dispute that selling prices should be determined according to the following formula:

Cost of Material plus Productive Labor=Prime Cost
 Prime Cost plus Factory Expenses =Factory Cost
 Factory Cost plus General Expenses =Cost to Make
 Cost to Make plus Selling Expenses =Cost to Make and Sell
 Cost to Make and Sell plus Profit =Selling Price

If this is true, how can the selling price be determined intelligently without a dependable system of accounting?

The Most Valuable System

A business system is just a means to an end. There is danger that the means may be made more important

than the end. As practical men you will agree that the best system is the one that gets the desired results with the fewest operations.

The results to be desired by the manufacturers of concrete pipe and tire are:

- (1) Accurate Costs
- (2) Control of Material
- (3) Classification of expenses for comparative purposes and intelligent analysis
- (4) Elimination of "leaks"
- (5) Monthly statements of profits or losses

Determining Costs

Material in the manufacture of concrete pipe and tile, consists of cement, sand and (sometimes) hoops. Stores accounts should be carried with each of the items of material and material used should be credited thereto and charged to the work in process when used. The difficulty of accounting for cement may be overcome by requesting the manufacturers of the cement to attach a tag to each sack shipped. This tag is removed at the time the cement is used and the tags are assembled in a bag which is marked to show the particular production in which the cement has been used. Sand may be either purchased and shipped to the plant or produced at the plant. In either case the weight of the sand used is determined by established mixture formulae with which you are all familiar. The cost of the sand, of course, is either your purchase price plus the freight or your own cost of production. Where hoops are used they are charged out to the lot on requisitions and as a given size of tile will invariably take a certain number of hoops there is no difficulty in obtaining a proper accounting.

Labor will be either direct or indirect. Direct labor is that which is applied directly to your production of tile or sand or construction work. Indirect labor is that which cannot be located as belonging to the actual production of tile or sand.

A time card has been devised which takes care of each machine instead of one which takes care of one man's time only. For instance, in a *Quinn* machine the card will show the size and number of tile produced and the length of time required. It will also show the time of:

- 1 Operator
- 2 Truckers
- 2 Stripers
- 1 Mixer
- 1 Helper
- 1 Man to put up sand

This will vary somewhat in the operation of a McCracken machine which will operate with:

- 1 Operator
- 1 Helper
- 2 Folders
- 3 Truckers
- 2 Stripers
- 1 Mixer
- 1 Man to put up sand

In order to operate on a money-making basis the crew should be large enough to keep kilns empty so that machine crews may be on machines continuously as the practice of using skilled men for general labor is very expensive.

It is necessary, of course, that all time be accounted for and reconciled with the actual time paid for.

Overhead expenses are the expenses of every kind connected with the business, none of which can be directly located as belonging to a particular production. These expenses, while part of the cost of production, are general, so can not reach the production direct; hence a method must be devised for them to reach the cost in an indirect manner, the method at the same time being so planned that each production will bear its fair proportion of the total.

Before deciding how overhead expenses are to be handled, it is necessary to determine just what items constitute overhead. A list of these items and their description must necessarily be very general and subject to change, as items of expense occur in some plants which are not present in others. Overhead may properly be divided into two classes—factory overhead, which consists of items belonging directly to factory operations, and general overhead, which is expense not directly connected with the factory.

The plant should be divided into departments which will correspond with the various processes of manufacture and any expenses distinctly applicable to a department should be charged directly thereto.

Monthly Statements

Many manufacturers wait until their yearly or half-yearly inventory to find out if they have made or lost money. So long as all conditions are favorable such a practice may not be harmful, but why should a responsible business man take chances which are unnecessary? Once the proper system is installed it is an easy matter to have monthly statements of operations and financial condition and if the results are not satisfactory steps may promptly be taken to remedy the conditions instead of waiting six months or a year and permitting the losses to multiply. There is the additional satisfaction of knowing where the business stands which appeals to most men forcefully, because no matter how practical he is, the American business man gets considerably more out of business than the financial consideration—the pleasure of planning, creating and directing an undertaking is fully as important to him.

An Investment, Not an Expense

The manufacturer who purchases a new machine does so because he expects the amount expended to increase his profits either from economy in operation or from an increase in production. He looks on this as an investment and not an expense. Office methods have been improved to quite as large an extent as machinery, and an investment in improved methods will produce a return just as will an investment in improved machinery. As in the case of a new machine the initial cost is not the principal consideration, but the economies and benefits possible in the future should be kept in mind.

Some time ago the Federal Trade Commission issued a bulletin stating in part:

"The fact must be admitted that in order to put a selling price on a product a manufacturer must first know what it costs to manufacture and sell it. When business was done on a large percentage of profit this was not essential, but in most lines of industry today the large percentage of profit has passed. Manufacturers are working on smaller margins and must absolutely know what their goods cost.

A manufacturer who does not know with a close degree of accuracy what it costs him to produce the different articles he manufactures and what it costs him to sell them, is not in a position to meet competition intelligently, and invites business disaster.

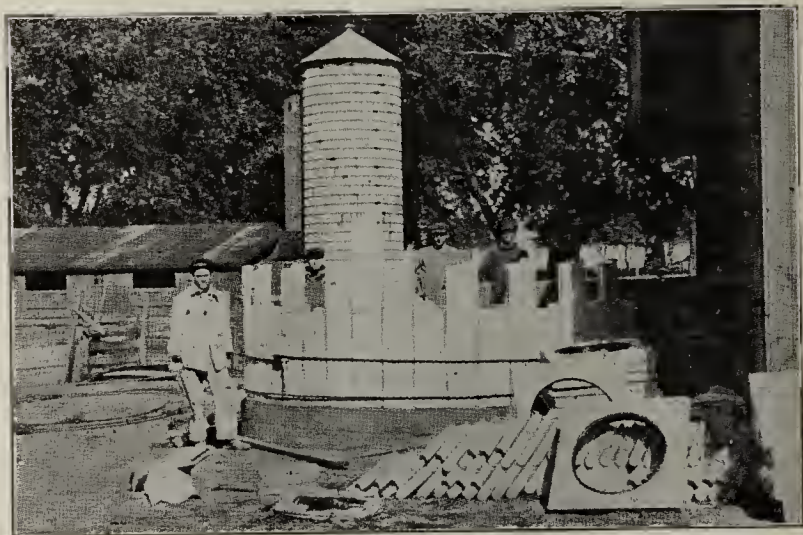
Proper accounting for the smaller manufacturer is most essential. It is necessary for his success that he know on what particular article he is making only a narrow margin of profit or losing money. If he has this information he can concentrate on the manufacture and sale of those products on which the profits are satisfactory.

Whole industries, in many instances, are suffering from a lack of intelligent knowledge of costs.

Markets for Cement Products

There is a large and increasing market throughout the country for concrete building block, concrete building trim, posts, drain tile, pipe and other cement products. City and country dwellings, public buildings, factories, farm structures, drainage and irrigation projects and railroad work constitute some of the best known markets. The great variety of building and improvement work into which cement products enter gives assurance of reasonably continuous demand. If one particular line is slack, another may be depended upon to keep the plant going.

Although cement products manufacture is essentially a local business, depending for its success largely upon the confidence of the people in the community where carried on, the possible field of operation is by no means limited to the hauling radius by motor truck or team. Many manufacturers have developed a flourishing business in outlying and rural districts because of the very favorable freight rates accorded to cement



Building Concrete Stave Silos

products. Silo staves, building block, drain tile and other cement products for which there is a ready farm market, are often shipped considerable distances.

Now is an usually good time to get into the cement products business. In almost every community there is not only a growing market for the present uses of these products, but an opportunity to develop new uses as well. Many communities remain as unsupplied markets because existing plants are not near enough to the market or are not sufficiently large to take care of the demand. Such conditions offer very favorable openings for the prospective products manufacturer.



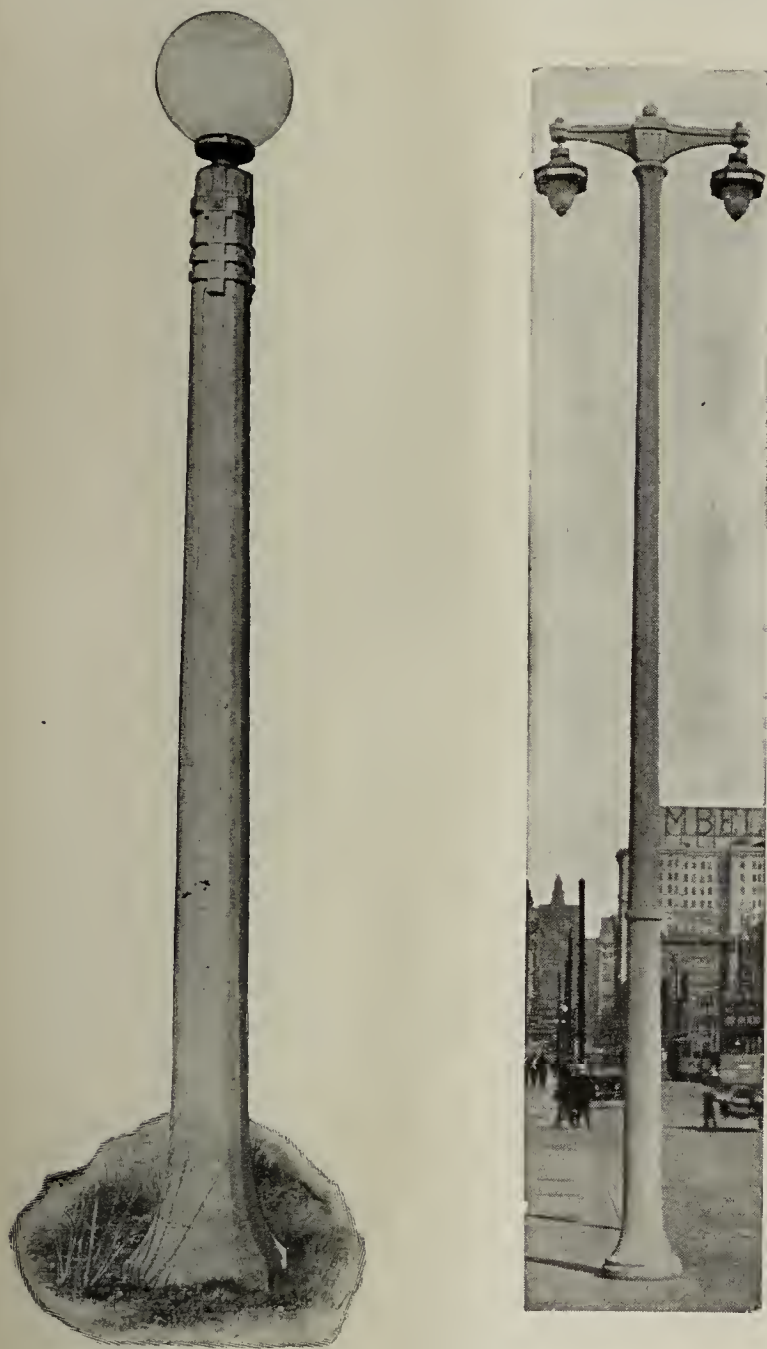
A Concrete Pipe and Tile Factory

Cement products manufacture can be made an all-the-year-round business, insuring steady employment and favorable working conditions for labor, and economical operation for the manufacturer.

Concrete Post and Pole Market

Permanence, together with the fact that they "stay put" has made concrete fence posts exceedingly popular. Increasing scarcity and consequent advance in cost of wood posts has also done much to increase the demand for concrete posts. At a very conservative estimate, the average farm of 138 acres requires 75 posts each year to replace ordinary breakage and wear of wood posts. This makes a possible market for 480,000,000 posts a year in the country for replacement alone. No end of opportunities to sell plain and ornamental posts, to parks, cemeteries, playgrounds, fair associations, make up another big market. Ornamental parts are in considerable demand for such uses, and this class of purchasers is usually willing to pay for first quality products.

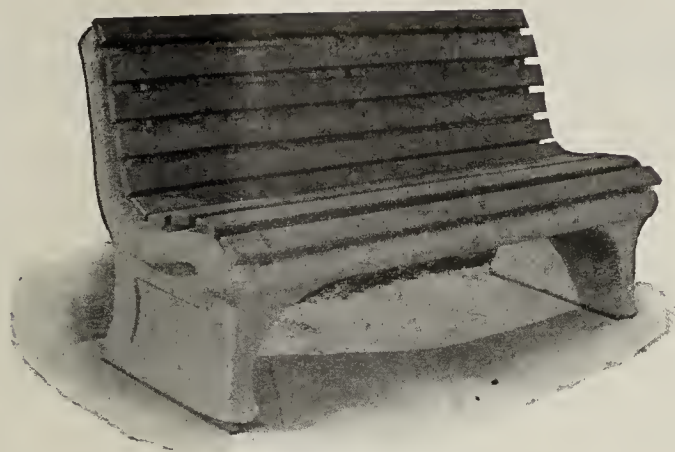
Everywhere cities are developing comprehensive street lighting systems. Concrete posts or lighting standards for this purpose are in demand because from



Ornamental Concrete Lighting Standards

considerations of beauty, durability and first cost, no other material is so suitable. Lighting standards can be made in a great variety of shapes, and by use of colored aggregates such as crushed granite, marble, quartz and mica, a surface appearance can be produced unequalled by any other material. Concrete lighting standards are decidedly ornamental and add greatly to the attractiveness of the street.

During the next few years, the concrete highway



Concrete Park Bench

marker is certain to come into its own. Already, several of the more prominent trans-continental highways have officially adopted concrete markers. Placed at an average distance of 1 mile apart, 500,000 markers will be required during the next few years along these highways alone.

Syracuse Suffers from Cement Plant Closing

Syracuse is suffering in a business way as the result of the closing of the Sandusky Portland cement plant there. The plant has not been in operation for many months, and according to reports from Syracuse, the plant may never again be operated unless deposits of limestone are found in that vicinity. The manufacture of cement from marl taken from the lake is said to be too expensive, making it impossible for the Syracuse plant to compete with plants that manufacture cement from limestone. Soundings are now being made around Syracuse in an effort to locate a bed of limestone.

It is reported that property values have been greatly lowered through the closing of the cement plant. Many persons who were employed at the plant have left town and there are many empty houses.

Finishing Warehouse Floors

The floors of the warehouse at the foot of Thirty-ninth street and Winchester avenue, Chicago, which was built for use by the United States Quartermaster Department, were left rough, that is, they were poured to within about $\frac{1}{2}$ inch from the top and when the concrete had hardened the surface was uneven. Later a top finish of 1:1½ cement, sand and mortar was applied dry as possible and the mixture was floated and troweled into a somewhat hard and uniform surface. This floor finish was mixed with a separate mixer operated by electricity and moved from floor to floor. The main mixing plant was kept busy with the upper floors while the lower ones were being surfaced.

The building was erected by E. W. Sproul & Co.; S. Scott Joy was the architect; A. F. Stein the structural engineer, and Maj. S. L. Nelson, construction quartermaster, was in charge of the work.

Forty-two Yards in Five Hours

John F. Keefner, manager of the Des Moines Building Materials Company, is a thorough believer in the use of motor trucks. Mr. Keefner does not believe that horse-drawn trucks should be entirely done away with as he finds that they still have some uses particularly their own, but he has come more and more to depend upon trucks for the heavy work of the rush season.

Shall Restrictions of Transportation Be Permitted to Limit Development?

By R. E. Fulton

Vice President, International Motor Co. Manufacturer of Motor Trucks.

With the constantly increasing volume of transportation upon our highways, the problem is one which will have to be met with the development of the future in mind, as well as the needs of today. There is only one thing we can assume as absolutely certain, and that is, the amount of transportation will continue to increase at an enormous rate every year.

The problem before us is not primarily good roads nor motor trucks, but how shall we handle the enormous volume of traffic that is increasing every year at a tremendous rate?

In meeting this problem, we must keep in mind first of all that transportation must be cared for; we cannot reduce it or abolish it. We have got to build our roads up to the demands made upon them by the needs of the people. We can not permit progress to be strangled by inadequate transportation facilities.

From an economic standpoint, the development of highway transportation lies in the use of larger capacity units, and not in limitations to smaller vehicles. If transportation efficiency is to be the standard, our highways must be constructed or rebuilt to carry satisfactory heavy motor trucks of even larger capacity than the largest now in use.

It is not difficult to picture the economic handicap to railroad transportation, and with it the curtailment of the wonderful development of this country, if the railroads had been forced to adhere to the 40-lb. rail, instead of advancing steadily to the 70-lb., the 80-lb. and 90-lb. rails which make possible the huge and powerful locomotives and heavy trains now in use. The only difference in the situation is that the roads are publicly owned, while the railroads are privately owned.

In the matter of initial cost of motor trucks, there is a marked gain in economy with the larger capacities. The cost per ton capacity in the case of the average half ton truck is \$2,028, for the 3-ton capacity vehicle \$1,322, and for the 7½-tonner, \$740. There is no doubt that the ratio of increased economy will hold for sizes up to at least ten and twelve-ton capacity trucks.

In the operation of trucks, we find increasing economy on the per ton load capacity basis, not in a few or even a group of items, but in practically every charge coming under the head of operating cost, from fuel to depreciation, and from driver's wages to insurance. Where large units can be used they materially decrease the ton-mile cost of transportation.

Comparing the 2-ton capacity truck with the 5-ton capacity, we find that in increasing the load carried 150 per cent, the operating cost is decreased 18.2 per cent; while comparing the 3-tonner with the 7½-tonner, there is also a 150 per cent increase in carrying capacity with a decrease of 22.8 per cent in operating costs. Unquestionably, this ratio will hold good for much larger sizes, so maximum transportation efficiency in motor transportation must be sought in vehicles with carrying capacity greatly beyond the largest in use today.

In view of these facts, our highways should be built to stand the amount of traffic that is demanded of them. Limiting the gross weight of any vehicle to less than 28,000 lbs. is shortsighted economy for the present that is storing up a large amount of trouble and

expense for the future. Roads must be built to meet the requirements, for the requirements cannot be limited to road conditions.

Home Building Program

Due to the difficulty the employees of the Westinghouse Electric and Manufacturing Company have experienced in getting homes near the East Pittsburgh works, the company has resumed the home-building program that was postponed during the war, and forty-eight houses are now under construction. The site for the new dwellings is on a plot of 109 acres owned by the company and located in Wilkins township along Ardmore boulevard.

The new houses will form a part of the general building plan for developing the entire tract. It is estimated this tract will furnish homes for six hundred families. Sidewalks and paving will be laid, and gas, water and electricity will be installed. The houses, which are modern in construction, will be of brick with hollow tile backing, with concrete cellars and cement porches. They will consist mainly of five, six and seven room houses designed to meet the needs and the pocketbook of the man in moderate circumstances and will be sold at cost on easy terms to the employees of the company. A number of the dwellings will be for rent.

In building the new homes an effort has been made to do away with features that have outlived their usefulness. The antiquated parlor is missing and the center hall has been replaced with a modern living room which is more economical of space. However, the plans are subject to change, as the dwellings are designed to meet the approval of the future occupants, whether owners or tenants. Those in charge of the building program have made a careful study of the war-time houses erected by the Housing Commission, especially those built in the Philadelphia district for the use of the employees of the Essington works.

The Westinghouse company is one of the pioneers in building homes for its employees, having constructed seventy-two homes near the Trafford foundry almost ten years ago, as well as owning 127 apartments and homes in Trafford proper. It is likely the building scheme at present under way will later include apartments and duplex houses. T. P. Gaylord, vice-president of the Westinghouse company, is in charge of the building program. Bernard H. Prack, the architect and builder, expects to have the first of the houses ready for occupancy by October 1.

Cement Co. Builds New Office Bldg.

Ground has been broken and the foundations laid for a new office building at the Glens Falls Portland Cement company property, Glens Falls, N. Y. The building, which is to be a one story structure with basement, is to be made of concrete and finished with stucco. The present office building has become too small to accommodate the growing business of the concern.

The new building will have a forty foot front and will extend back sixty feet, covering about 2,400 square feet of ground. It is expected to be ready for occupancy late this fall. The main office is to be on the main floor of the building while the basement will be occupied by the laboratory.

E. B. Potter of this city designed the building and has the contract for erecting it.

How a Sand and Gravel Dealer Uses Motor Trucks Efficiently

Construction of all kinds with concrete is specialized by the John T. Scully Foundation Co., East Cambridge, Mass., the largest concern of its kind in New England, because through the economies of handling material with power trucks it can undertake contracts for work within a zone of three miles from its plant far more advantageously than any other building company. This does not mean that operations could not be carried on without trucks, but the use of machines for haulage maintains a uniform and extremely high degree of efficiency in transporting materials from the points where obtained to where used, so that cost can be reduced to minimum.

This efficiency results from the equipment of the plant, the materials used, the method of operating and doing work on a large scale. In all its building, unless so far inland that other than its regular sources of material supply are drawn upon, no manual labor is employed aside from the operation of the machinery and facilities, and no shovel, for instance, is used until actual construction is begun.

Some of the sand is dredged from reefs or banks along the coast within a distance of 50 miles from Boston, or is taken from a big deposit at the shore, conveyed in steam vessels to East Cambridge, transferred to "hoppers" having storage capacity of 10,000 tons, loaded by gravity into trucks, hauled to the building site, and discharged at the exact place where it is to be used and discharged by gravity. Sand, gravel and crushed stone are taken from a big plant at the water's edge, loaded into vessels and brought to East Cambridge and similarly distributed. Quick work and large volume means economy, of course, and this must be continuous that a profit can be made.

The company owns more than 1,000,000 square feet of water front property in East Cambridge close to the Charles river basin, in which there is a canal or water way in which a score of small vessels can be moored at once.

Their sand "hopper" is a rectangular structure of wood, erected on 16 heavy concrete walls and wood trestles. These walls and trestles are such height that carts or trucks may be driven under the "hopper" in any one of the 15 alleys or "tunnels," and in the floors of each of the bins above the "tunnels" are three square outlets, closed by gates, through which the contents of the bins are discharged by gravity. There are six gates to each bin.

The "hopper" is heavily built, strongly braced with many large steel rods in either direction, and all the bins are open at the tops. There is a wide railed platform the full length that is reached by a ladder from the ground. The "hopper" will hold 10,000 tons of material, and from it 30 horse carts, two to each tunnel, or 15 trucks, one to each tunnel, can be loaded in a minute. The gates are operated by hand levers and these are so arranged that they can be operated individually by the drivers in the event of need, or they may be operated by a yard man.

Because the "hopper" must be near the edge of the wharf the trucks and carts cannot be driven through the tunnels, but must be backed in and drawn out into the yard. This construction was decided as being the better, although faster loading could seemingly be done were the vehicles driven through the tunnels. The bins can be loaded direct from the water front without the use of conveyors on the top of the structure that would be costly to construct and would necessitate constant and more or less operating expense. Not only this, the absence of superstructure

above the "hopper" considerably increases the storage capacity of the plant, because the sand, gravel and stone can be, and often is, piled to a height of 20 feet or more above the tops of the bins, and this additional stock improves the gravity discharge instead of retarding it. Each bin can be used separately for different materials and they can be used in series for any one grade if there is need of handling this in extremely large quantities.

Sea Sand for Making Concrete

The company handles two qualities of sand, that which is taken from sand banks and the other that is dredged from shoals and beaches along the coast within a radius of about 50 miles. The sand is supplied by contract by the Boston Sand and Gravel Co., which operates a fleet of nine steam lighters or sand boats, these being especially built vessels that usually are expected to make one trip a day and are in service the greater part of the year, if not continuously. What is known as sea or beach sand is dredged in shallow water at Plum Island, at Salisbury and other beaches nearby and at Newburyport, Mass., and with clam-shell buckets the loads, which range from 400 to 1200 tons, are taken on in several hours without regard to the tide or depth in which the sand is obtained. Each vessel is heavily built for this work, powerfully engined and equipped with hoists, cranes and derricks.

Moored against the canal wall the vessels are unloaded by the same apparatus used for dredging, the big two-yard clamshell buckets being operated very quickly by power. The sand is lifted from the vessel to a height of 60 feet and dropped into the bins or piled high on top of them. Some idea of the unloading possibilities may be gained from the fact that on one occasion when the gates or the Charles River Basin dam were being repaired the company was given from 5 o'clock Sunday afternoon until 8 o'clock Monday morning to take vessels in and unload them. This gave 15 hours' total time, and in 13 hours 2,800 tons were unloaded. When two vessels are at the wharf from 400 to 500 tons an hour can be handled.

Because of the sand being wet by salt water it never freezes and it can be discharged from the bins as readily in the coldest weather as when the temperature is high, and because it will not freeze it is especially desired by contractors for work done in winter. Not until within a short time, however, has the value of salt in concrete been known, all fearing to use sea sand because of belief that the construction would not be substantial. Now, however, contractors for concrete work who use bank sand mix salt with it if the temperature is low to prevent freezing, but the mixture cannot be made as perfect with bank sand as with sea sand. For this reason there is a constantly increasing market for this material.

High Efficiency Material Handling

The bank sand is obtained by the same company at Third Cliff, Scituate, Mass., which is reached by a dredged channel nearly a mile long through flats from the sea to a small basin where several vessels can be loaded. The railroad station is Greenbush. The plant has capacity of approximately 4,000 tons daily, and the equipment is extensive and costly. Sand of different grades, gravel of different sizes and crushed stone to two inches square are obtained here, a stone crusher being worked constantly. The sand and gravel are taken from the pits by cars and carried up an incline, the sand to storage piles and the gravel to a separat-

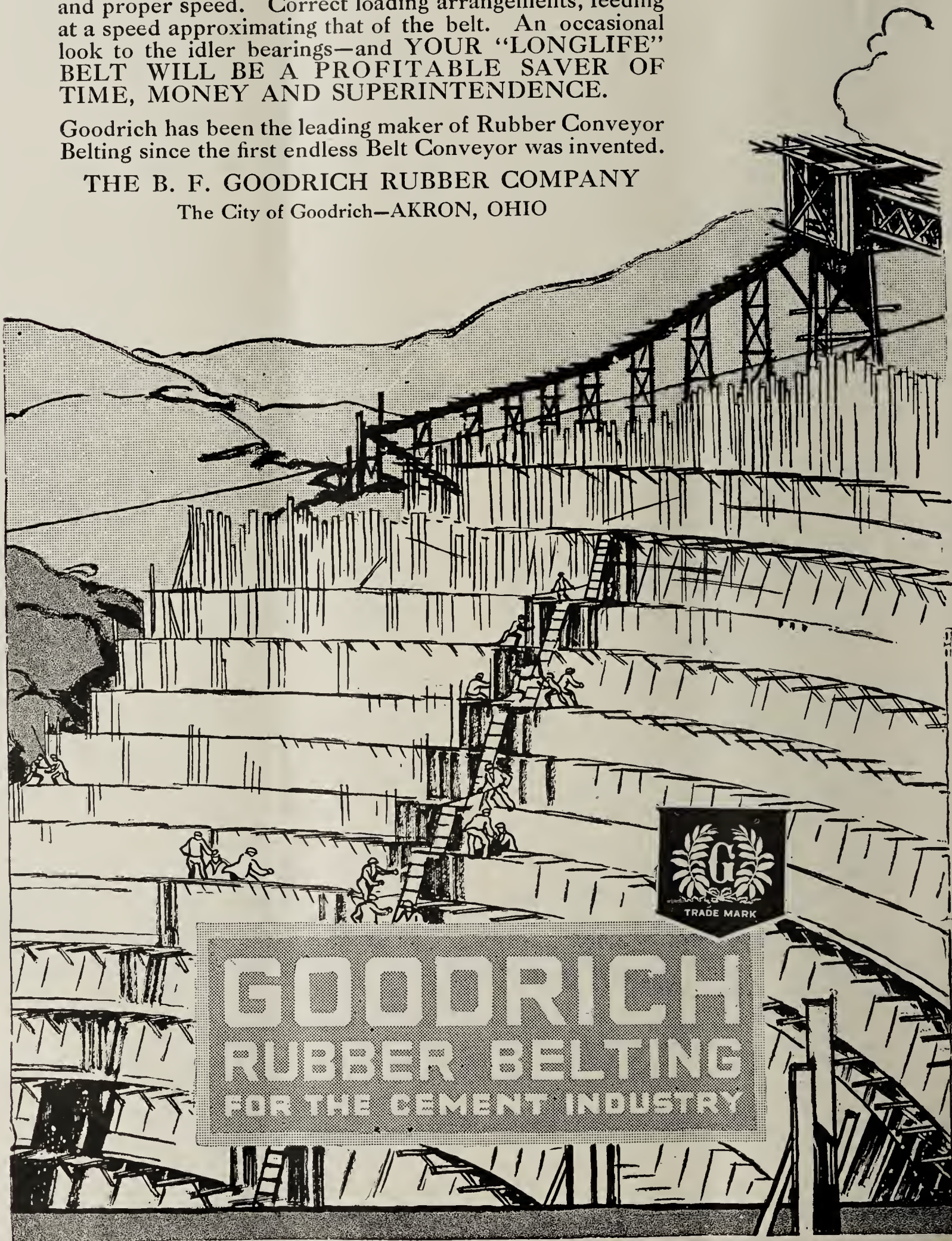
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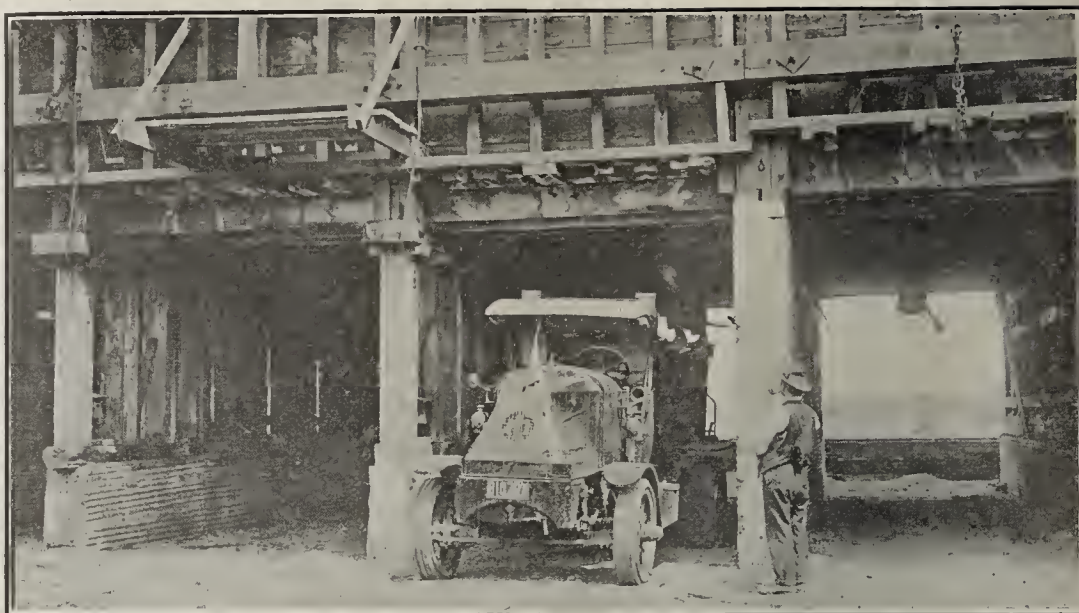
ing and washing plant. Here the gravel is run through the separating screens, which grade it according to size, washed when necessary by streams of running water, and then carried out and dumped in great piles. The material is heaped over gates in the ground, under which are tunnels about six feet square in which are large belt conveyors operated by machinery.

The ends of the conveyors extend beyond the wharves where the vessels are moored and when the boats are brought in for loading they are positioned with the pockets centered under the conveyor ends. Above the tunnels the material is in piles, each of which is a grade of sand, gravel or crushed stone of varying sizes. A series of levers are connected with the gates above the tunnels, and when any specific material is wanted the gate that supplies it can be opened by a lever operated by a wharf man, and the sand, gravel or stone drops by gravity on to the conveyor belts and is carried to the ends and falls into the pockets in the vessel. The loading capacity of these conveyors is 400 tons an hour, so that in three hours the largest vessel, the Maxwell, can be fully loaded. The larger craft are fast, having speed of 16 knots an hour and the runs between the plant and the points of delivery can be made with better average speed than could be made with railroad cars. There is much time economy in loading, because the conveyors can be kept continuously in operation. The company makes shipments by car, but not to the same extent as by water, for the vessel transportation is cheaper.

Yard Equipment Very Economical

One will understand that in obtaining either sea or bank sand as described the highest efficiency has been developed, and the cost is minimized, which means cheaper material. This low cost insures a market and a certain and satisfactory profit within a given area.

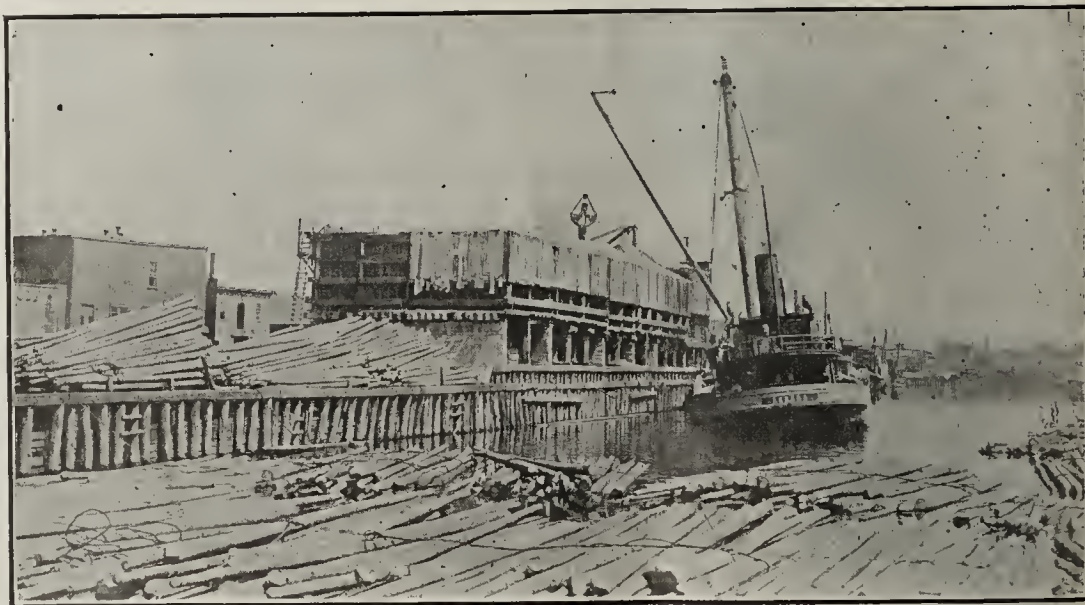
Just as the Boston Sand and Gravel Co. has invested large amounts in equipment and plants to minimize production and transportation cost, so has the John T. Scully Foundation Co. equipped its yard and provided facilities for doing its work cheaply. Because it has many and large contracts for foundation building, it has 32 hoisting engines to use with derricks for driving piles. One contract required about 1,500,000 linear feet of pile driving alone. It has different types of concrete mixers. It has a lumber yard where material for building



Mack 7½-Ton Truck Backing Into One of the "Hopper" Tunnels to Take on a Load of Material—Loading Usually Takes Two Minutes



The 10,000-Ton Building Material "Hopper" in the Yard of the John T. Scully Foundation Co., at East Cambridge, Mass.



Piles in Storage in the Water and Yard and the Material "Hopper" of the John T. Scully Foundation Co., Seen from the End of the Canal.

concrete forms are stored, and a saw mill where the lumber is cut and forms to meet specification requirements are built. This part of its plant is operated by electric motors. The equipment is generally widely scattered, and frequently all is being operated. When not in use it is kept in the yard. Because of the work the apparatus is heavy and not infrequently a large tonnage must be hauled to a work and from it when the contract is completed, in addition to materials used for construction.

Last year nearly 200,000 tons of sand, gravel and stone was received at the yard and distributed to different works, and besides this similar materials were received by car for contracts that were so near to railroad sidings and so far from the yard that handling with shovels or loading equipment and carts was more profitable than extremely long hauls. Where cars can be located close to a contract and received in sufficient numbers to afford a satisfactory supply of materials, shipments from the pits and quarries may be made by railroad, but in every instance these cost more than where sea sand can be used.

With reference to transportation of materials, the market values are so small and the margins of profit so slight that these do not justify more than what would be short hauls for more valuable commodities, and the delivery or haulage zones cannot be extended without corresponding increase of prices.

Low Cost of Material Is Vital

Material prices cannot be increased so that deliveries can be made longer distances than are made by competitors unless there is exclusive control of what is required by all contractors, and the expense of haulage will very quickly offset any advantage that may obtain in production. The price of sand at the yard of the Scully company will average \$1.50 a cubic yard, which will weigh about 2,400 pounds.

When the company began to deal in sand and gravel and stone a great deal of attention was directed toward keeping the cost of delivery as low as possible. The work was originally done with horses and carts and caravans. Good animals were bought and well cared for and carefully worked. The company established a blacksmith shop to forge fittings and make and repair tools, and shoe the animals. Then a wheelwright shop was built and equipped to build the vehicles and repair them. As operations extended the company had 110 horses. There were times, however, when it hired teams, drivers and carts to keep up with its work.

Keeping Haulage Cost at Minimum

The necessity of minimizing transportation expense was quickly realized and this impelled careful supervision and accounting of work and operating cost, and every endeavor was made to economize time and labor. Records were made of the work of all men and the teams they worked and expenses of each contract were computed with extreme care. Only through definite knowledge of the cost of every work was there possibility of learning the earnings from numerous contracts that were being carried on simultaneously.

In connection with this attention to time and labor economies of hauling equipment study was made of routes and distances of delivery, and several route maps were made. With the yard as a centre the maps show the most direct routes to reach any given part of Boston and vicinity and the exact distances when any of these are traversed. These were studied and the drivers were instructed to drive so as to avoid congestion, grades, poor paving and other conditions that might cause delays or loss of time, and with knowl-

edge of the points of delivery very close estimate of the work that was practically possible could be made.

Time and Labor Saving Equipment

All carts used were either a rear end or bottom dumping type, that discharged loads quickly, and as the loading was done by gravity and with practically no loss of time at either end of the delivery trip, the only causes of reasonable delay might be en route in either direction, unless there were congestion or soft or obstructed ground at the point of unloading. With the loading facilities absolutely under control the carts could be kept moving systematically and regularly. The average hauls were found to be not more than three miles, and very seldom was delivery made a greater distance.

The haul from the "hopper" to the street is through a wide drive in which vehicles can pass, and those going out cross a large scale at the office, which is in a two-story building at the street end, where the vehicles are weighed as they drive out loaded. Each driver is given a loading slip on which is the name of the job or customer, the street address, the weight of the load, and on this is stamped the time of weighing. The drivers present the slips for receipting when the loads are delivered, and turn them in when they return, when they are again stamped with the time. Thus each slip is a complete record of the work and the time of the vehicles.

First Experiment with a Tractor

This method of operating was followed when four years ago the company, believing power vehicles might result in economy through greater load capacity and increased speed, decided to purchase a tractor and a 10-ton semi-trailer for experimental purposes. This was worked for a considerable length of time and the chief criticism of its practical possibilities was that it was slow and the disadvantages of not being constructed so the body could be automatically hoisted for unloading, was not compensated by its greater load carrying. A thorough trial was given and it was disposed of and three other trucks of smaller capacity were tried.

During the time the tractor and trailer was being tried the Boston Sand and Gravel Co. established its plant at Third Cliff and the Scully company made contract for a supply of material from it. This gave the Scully company an extremely large source of supply of every quality of material and which made it a very important factor in the construction of concrete of every description, as well as strengthening it because of the exceptional location and facilities for handling large tonnage.

Now Operates Nine Trucks

Eventually the three trucks were sold and in turn the machines that are now operated were purchased, one each of three different makes, and three different sizes. These were bought early in 1916 and later in the year a two-ton machine was added. Then a second two-ton motor truck was placed in service, and this year the company bought two more 7½-ton and two two-ton trucks. All of these machines are equipped with power dumping bodies, and there is seldom need for the drivers to leave their seats. This is one time economy that is of considerable importance.

Another factor of value from the viewpoint of the builder is that the trucks dump the loads from a height wherever desired and the material is in a sense "stacked" so that it takes less room and the labor of handling it is more or less decreased. The loads of animal carts are dropped practically at the level of the ground and are necessarily spread as the vehicles are

drawn away, so that the material is more widely distributed and labor is required to place it where it is wanted.

The trucks can be quickly and exactly driven to unloading places, and carts cannot be worked as fast or as accurately. Contractors want the material delivered so that there will be the least handling possible. Many now build unloading platforms at different places where a work is progressing so that the materials can be placed so that manual labor is minimized. They find the expense of building platforms affords a decided labor economy. Such unloading facilities at the same time are a practical vehicle economy, and where the contractor and material dealer both plan to save labor and operate co-operatively, each benefits to a considerable degree.

Importance of Placing Loads

The importance of placing loads has still another aspect that is regarded by contractors as sufficient to influence material dealers in choice of equipment, and this especially applies to concrete construction, where the mixing is done at the job. The material must be delivered at the mixers, even if there is plenty of working space, but where practically all the work must be done within the building site, and storage outside of the structures is impossible, or would entail re-handling, provision is often made for the trucks to be driven into the site or the partly completed structure so that the loads can be dumped and the material can be mixed with a single handling.

In some instances delivery is made into chutes into basement excavations, or in bins or pockets at elevators. A considerable number of buildings have been erected by the Scully company where the only shoveling or handling is at the mixers. This is a decided economy, and where the space is small the value of "stacking" the material is obvious. When the build-construction is to such a plan the floor may be temporary planking laid on walls or girders and not secured, so light trucks that will not require heavy construction are more desirable, even though the loads are smaller, and they are expected to work faster on the streets.

The heavy machines will carry larger loads, but they cannot be driven as rapidly where there is congested traffic and stronger temporary construction requires more time and is more expensive. Thus one will understand that the Scully company has found very large trucks and comparatively small machines both adapted to its work. Seemingly it has determined what sizes will best meet its requirements although there may be reason found later on for still further changes.

When one reflects upon the fact that from the time the material is taken from the sea or bank or pit it is handled entirely by machinery in large quantities, and labor aside from operating the machinery is confined to mixing and pouring the concrete into the forms, the high efficiency of contracting as done by the Scully company is apparent. Reduction of labor is a real factor, and the greater the degree that this is done the more the profit that can be obtained from a work undertaken at prevailing prices.

Trucks Very Carefully Maintained

The trucks are maintained very carefully. A foreman mechanic is employed who is responsible for the mechanical condition of the machines, he working whenever there is need, and so far as possible work is done nights and other times when they are not operated, as during rain or Saturday afternoons, Sundays, holidays, etc. He has a helper who may in an emergency drive a truck for a day or two. In the shops and the garages are all the tools for doing practically

any work on the machines, and adjustment, repair or overhauling is undertaken.

The machines are inspected each Sunday, and generally once a week, the Sunday inspections being thorough, and in connection with which whatever work needed is done. The week day inspections are with reference to particular conditions as a rule, such as the steering knuckles, steering linkage, brakes, chains or parts that are exposed, and the work may be adjustments or perhaps temporary repair to serve until a permanent restoration can be made. The intention is to examine the trucks very frequently and do immediately whatever work is desirable, so that there shall be minimum wear and the machines can be constantly serviceable at the least possible expense and will have the longest possible service life.

Careful Maintenance Is Economical

This system of operation and maintenance of course minimizes large expense and there is increased revenue from the fact that there is very little lost time. The repair bills are usually small items and when overhauling is done the cost is relatively low. The matter of overhead expense, which includes interest on investment, taxes, insurance, garaging, water, rent, lighting, clerical work, supervision, office expense, etc., is made up of items that are practically the same with any truck equipment, and others that are decidedly decreased by careful accounting and by attention to operating detail. The operation expense, however, which includes fuel, lubricants, tires, supplies of all kinds, wages, repairs and maintenance, are all variable aside from wages, and much care is given to minimizing these without lessening efficiency.

Careful record is kept of fuel and oil consumption, as well as mileage and tonnage, and comparisons of these are constantly made so that there is a thorough knowledge of work done and the expense with different drivers and different trucks. The delivery receipts check the work and the time of the men. Ordinarily the odometer mileages are checked by the route maps. The drivers work from 7 in the morning until 6 at night, with an hour for lunch. They are carefully selected men who are exceptionally paid and the company is convinced that they do their part to obtain truck efficiency.

Records Are Very Complete

The mechanical records of the trucks are made by the foreman mechanic and kept by the office. There is a record book for each truck and in this is entered every item of adjustment or repair, the dates of periodic lubrication and other facts that will guide the attention given. The cost of parts and labor are also included. In the office a complete record is maintained of each vehicle. The tire expense is kept with equal care, and of course with heavy loads and the conditions in which they are operated the cost is large as compared with other work, but it is not excessive. The trucks are all equipped with solid band tires that are oversize for the machines, and this is regarded as good economy. The trucks are used for material haulage save when piles are carried, when the bodies are fitted with special rigging.

The capacity of the plant for handling material may be stated as from 700 to 800 tons an hour, and frequently at morning or noon when the vehicles are starting work 325 tons have been weighed out in 20 minutes. In working the trucks they are sent on alternate short and long hauls so that they will have such headway that there will be no congestion when the loading must be done in but a few of the tunnels of the "hopper." The carts and outside vehicles are so handled in loading that there is no conflict with trucks.

The Contractor and the Cost-Plus-Fee with Bonus for Efficiency

By E. T. MORRISON

of Morrison & Beck, Consulting Engineers, Chicago

The subject of "Cost-Plus-Fee Contract" has been given a great amount of publicity. As a result we find that there are many who favor the adoption of the forms of contract and many who do not.

It is generally recognized that the lump-sum contract is far from the ideal form as it based on the false assumption of the possibility of preparing perfect drawings and specifications which will accurately describe the work in a manner that will have no question as to the meaning and interpretation of each particular part. This cannot be done; at least we cannot be sure that the minds of both the contractor and architect or engineer have met on every particular part.

In addition to the difficulty of drawings and specifications, there is the speculative feature of the labor and material market which at the present time it is almost impossible to forecast.

Thus we see that the lump-sum contract is not based on an accurate estimate, but upon speculation, and the low bid is always made by the contractor who will risk the most or who has made the greatest error.

In the "Cost-Plus-Fee Contract" the owner, architect or engineer and the contractor become partners to build a particular structure. The contractor becomes the construction manager for the owner. He is selected on the basis of his service record and his knowledge and experience in construction is united to the professional ability of the architect or engineer in design.

The contractor's profit is no longer the difference between actual cost of the work and the contract price, but is a fee paid to the contractor to cover and include his profit, the use of his organization, his skill and energy, overhead expenses and services.

Practicability of "Bonus for Efficiency"

When the "Bonus for Efficiency" feature is added, there are certain modifications of the profit fee as follows: The contractor is paid the actual cost of the work plus a profit fee. If the actual cost of the work is equal to the approved contractor's estimated cost, the contractor is paid the profit fee in full. If the actual cost of the work is less than the contractor's estimated cost, the contractor is paid the contractor's profit fee, and in addition thereto, one-half of the amount which the actual cost of the work is less than the contractor's estimated cost.

Here is an inducement for the contractor to use his energy to increase the efficiency of his organization, and as an extra spur the following penalty for not using due diligence is added: "If the actual cost of the work is more than the contractor's estimated cost, the contractor will be paid the contractor's profit fee less one-half of the amount which the actual cost of the work is in excess of the contractor's estimated cost, but in no event shall the contractor be paid less than the actual cost of the work, plus one-third of the contractor's profit fee."

Contract Fair to All Concerned

Here we have a form of contract that is fair to all parties concerned. The contractor's estimated cost is checked and approved by the architect or engineer. This approval covers the various items and the quality of material so that there is no further offering of substitutions, and as the owner pays directly for all materials and enters directly into contract with the subcontractors, many misunderstandings are avoided.

The owner, having selected a capable contractor, knows he is getting exactly what he pays for and that

he has placed the construction of his building on a modern business plan. In the contractor he looks for service, and the contractor enters into the contract with a free mind knowing that it is service that he is selling and that he will not be called upon to pay for the privilege of building the structure. Instead of working against each other, the owner and contractor work in harmony towards a better piece of work and an economical handling of the construction.

W. I. Alling Becomes Field Sales Manager for Oshkosh Manufacturing Co.

In carrying out its idea of complete service to both the dealer and user of Oshkosh concrete machinery, the Oshkosh (Wis.) Manufacturing Co. has recently created a new position, that of field sales manager, and has appointed W. I. Alling to handle that department.

"Bill" Alling is well known in the contractors' equipment field. He has for years been associated with some of the best known firms in this line of work and has held many responsible positions. He was for some time in the sales department of the Eureka Machine Co., selling contractors' equipment of various kinds and types. Prior to his connection with the Oshkosh firm he was sales manager of the con-



W. I. Alling

tractors' equipment department of the Lansing Company.

Mr. Alling's duties will consist not only of managing the field sales of the Oshkosh Manufacturing Co., but he will also have direct charge of the field service of this firm, traveling from agency to agency, explaining and amplifying the service and co-operative plans, not only to Oshkosh dealers and representatives, but to contractors as well.

Byers Auto-Crane

The John F. Byers Machine Company, 204 Sycamore St., Ravenna, Ohio, has installed one of their Model 3 Byers Auto-Cranes in the quarry of Tate Gannister Rock Company, Bedford, Pa. The crane is equipped with $\frac{1}{2}$ yard clam-shell bucket to be used for stripping purposes, and will also handle a skull cracker, to break the boulders down to man size. This is a very interesting installation.

Quarry Stripping with Conveyor and Steam Shovel

Stripping at the quarry of the Diamond Portland Cement Company is handled very economically by means of a conveyor operated in connection with a steam shovel.

This interesting piece of earth stripping equipment is described by Mr. Oliver Bowles in a bulletin, "Rock Quarrying for Cement Manufacture," issued by the U. S. Bureau of Mines. The conditions at the plant may be stated briefly. The mill has a capacity of approximately 1,500 bbls. per day and it is expected this capacity will be increased. This necessitated a daily consumption of about 387 tons of lime rock, which is obtained from a formation located on the same property a short distance from the mill. The lime rock formation is nearly level but is covered by an overburden of soil, clay and shale varying in thickness from a few feet to 40 feet. The rock formation is only 8 feet thick and an overburden largely in excess of the rock which is secured must be removed.

The method originally employed to remove this overburden was to use a steam shovel for digging and narrow gauge tracks and dinky locomotives for hauling the soil to the dump.

The inclined conveyor offered choice of two systems: cars working on tracks or a large belt conveyor. Many arguments were advanced in favor of the belt and it is believed that under many conditions it would prove satisfactory and of enormous capacity. In this case, however, the fact that some of the material comes away in large, hard masses and in consideration also of the likelihood of trouble from operation under severe conditions in winter, it was decided to adopt the car and incline type.

Early in 1915 an order was placed for a portable inclined railroad, which was installed and put into operation in April, 1915. The conveyor, which is shown herewith, consists of a main platform about 30 ft. x 30 ft. mounted on four 100-ton standard gauge railroad trucks. The superstructure of the platform is a double track railroad, 175 feet long, at a 20-degree angle, supported by a suitable structural steel frame work. The track extends near to the ground level at one side of the platform and, running across the platform, overhangs 100 feet on the opposite side.

The operating machinery is housed in a shelter on this platform. It consists of a 42x36-inch double friction drum hoist direct connected to an A. C. motor. The operator's cab, with levers, is placed so that a



Quarry Stripping at Diamond Cement Plant.

As the demands of the plant increased it was found that even working 24-hour shifts would not enable the rock to be stripped fast enough to meet the needs of manufacture. The cost of maintenance and operation was very large, especially as the thickness of the limestone was so slight that continual changing of tracks was necessary.

An investigation for possible solutions of the problem narrowed to two choices of equipment. A steam shovel, with the necessary power to dig the hard overburden, and with a reach long enough to deposit it beyond the working bench in a spoil area from which the limestone had been stripped, or a conveying system which should accomplish the same work in connection with the steam shovel already in use.

Investigation showed that a shovel of the requisite size to meet both requirements would have a capacity largely in excess of the requirements. It would therefore necessitate keeping the shovel crew employed at other work about half of the time. The first cost was also found to be high.

clear view of the work is to be had at all times. On each of the tracks is a 5-yard skip car connected to a cable which runs up the track and over a system of sheaves at the upper end and back to the hoist drum. Each car works independently and is hauled by its own drum. The conveyor is served by a steam shovel with a 2½-yard dipper. Two dipperfuls load the skip car and the operator immediately hauls it to the top of the incline, where it is automatically dumped. The car returns by gravity and in the meantime the other car has been filled, so that when the empty car arrives from loading position the operator at once picks up his second load. The time consumed for the round trip of the two cars, including loading, is about 80 seconds. Connected to the hoist with a worm drive is a drum which is used in moving the excavator on its tracks along the working bench.

The performance of the equipment has fully met the expectations of the purchaser. It is comparatively low in first cost and is operated by one man outside the regular shovel crew, with the help of the regular

quarry force for preparing and taking up track. The capacity of about 1,500 cu. yds. per day. does not by any means tax the full capacity of the equipment. A notable advantage in the use of this machine is the wide work space it clears, leaving a clean strip of rock 100 feet wide at the base of the bank.

It is, of course, impossible to give cost data that will show fully the comparative cost of the new and old methods of handling earth, but Supt. H. G. Raff, of the Diamond Portable Cement Co., states as his belief that the cost of stripping is close to 3 cents per cubic yard as compared with 10 cents by the old system. Accurate comparison is impossible because the machine is not worked at full capacity, whereas the former equipment was overloaded and therefore subject to exceptionally high maintenance. The indirect saving is very large. It results in a considerably reduced working force, it avoids night work in the quarry, and it insures ample raw material at the mill at all times.

Road Building Boosts Sand and Gravel Business

Big Indiana Concern Operating Three Plants at Full Capacity

The rivers of our country not only provide water transportation, but they also indirectly assist in road transportation by furnishing sand and gravel for road building.

This is particularly true this year, and especially with the Ohio River, as the states adjacent to it are unusually active in good road building.

which carry it to storage yard and bins which have a capacity of 1,000 tons.

This unloading derrick is equipped throughout with Hercules (Red-Strand) wire rope.

When freight shipments are made from this plant, the unloading derrick places the materials directly into the cars.

At the Mount Vernon plant the sand and gravel is unloaded by means of a derrick boat into a hopper which fills cars that operate on a wire rope incline, and which in turn are dumped at storage yard. Here



The unloading derrick at the Evansville plant

is another derrick that stores the material in such a manner as to utilize all of the storage space.

There are two steel cars on this incline; one goes up with a load as an empty comes down. These in-



The plant at Mt. Vernon, Indiana. Material is brought to this storage yard from the river by means of a wire rope incline.

In our last issue we described a large Ohio River plant at Louisville. Now we are glad to show views of the three plants operated by the Evansville Sand and Gravel Co., of Evansville, Ind.

The main plant of this company is at Evansville, but plants are also operated by them at Mount Vernon, Ind., and at Henderson, Ky., the latter under the name of the Stratman Hoisting Co.

Material for all of these plants is obtained from the river bed by means of suction dredges, and both the Evansville plant and the Mount Vernon plant operate their own dredges, while material for the Henderson plant is produced and delivered by the Evansville equipment.

As the sand and gravel is pumped from the river it is screened and loaded on barges which are towed to the landing by means of steamboats.

At the Evansville plant, material is unloaded by means of a stationary derrick into 2½-cubic yard cars

cline cars can be emptied directly into freight cars when necessary.

An incline is also operated at the Henderson plant,



A section of the incline at the Henderson (Ky.) plant

which likewise empties into a 500-ton storage yard or into cars, as desired.

A season's capacity of the Evansville plant is about 100,000 tons of sand and gravel. The Mount Vernon plant has a capacity of about 75,000 tons and the capacity of the Henderson plant is about 30,000 tons. An operating season is about eight months. Because of the extensive road-building programs of the states of Kentucky, Illinois and Indiana, this year, it is estimated that their entire capacity will be required to meet the demands.

The officers of the Evansville Sand and Gravel Company are William Eichel, president; Phil B. Frey, secretary, and Bert Koenig, manager.

New Mixer and Hoist Catalog

The American Cement Machine Co., Keokuk, Iowa, is circulating catalog No. 18, H20 and P20.

Catalog No. 18 is a well-presented treatise touching both upon the mechanical and theoretical structure of Boss mixers. The catalog is very complete as to illustrations, descriptions and explanation. It contains several very interesting and instructive tables of comparisons of Boss mixers, as well as mechanical drawings. The later part of the catalog is devoted to hoisting machinery.

Catalog H20 is devoted entirely to hoisting machinery and elevators of various sizes and for numerous uses; driven by either gas, kerosene or electricity.

Catalog P20 features mixers with special loading devices, automatic power chargers and measuring batch hoppers.

concrete at the surface and result in the accumulation of dust. The continual wear of concrete surface is termed "dusting."

The proper time to prevent dusting is when the concrete is mixed and placed. Build permanence into the concrete. It has been shown by a series of tests made at Lewis Institute, Chicago, that too much water in the concrete when mixed and poor curing methods are the chief causes of dusting surfaces. These tests were made on 300 blocks 8 inches square and 5 inches in thickness. The mix consisted of one volume of cement and four volumes of mixed aggregates which is equivalent to a 1:1½:3 or 1:2:3 mix as generally used for concrete made to withstand high stresses, or to form the wearing surface of pavements.

The blocks were made with different amounts of mixing water, and were stored under four different conditions:

- (1) Damp sand, four months.
- (2) Damp sand, 21 days, air 99 days.
- (3) Damp sand, 3 days, air 117 days.
- (4) Air of laboratory for entire curing period of four months.

All blocks were tested at the age of four months.

Proper Curing Makes Hard Wearing Surfaces

The tests showed the drier mixes to give an increase in wear from 0.5 inches for concrete stored in damp sand for 21 days to 1.1 inches for concrete in air for 99 days; the tests indicate that 10 days in damp storage would give a wear of about 0.65 inches. For the wetter mixes the wear after 21 days in damp sand is about 0.85 inches, for 10 days 1.15 inches, etc.



A section of the storage bins of the Evansville Sand & Gravel Co., at Evansville, Ind. This view also shows one of the incline cars that carries sand and gravel to the bins.

How to Prevent Dusting and Rapid Wearing of Concrete Floors and Pavements

Care Used in Mixing and Placing Results in Permanence

The surfaces of concrete pavements, floors, loading platforms and other constructions which are subjected to constant wear have not always given satisfactory service to the owners. This is due to the concrete not being properly mixed, placed and cured for surfaces of this kind. The grinding action of vehicles and industrial trucks will in a short time break up such

In view of the important influence of plasticity and curing conditions of concrete shown by the tests, it is doubtful if there is any phase of concrete work which will pay such high dividends as a little care to see that the proper amount of mixing water is used and desirable curing conditions are provided. In many instances the quality of the concrete can be vastly improved at trifling expense, but on the majority of jobs nothing is done because those in charge do not appreciate the importance of care in these directions. Practically all of the faults of concrete floors and pavements follow from these two causes. Excessive wear and dusting are certain to result when the concrete is not allowed to have the water necessary for hydration. It is notable that dusting never occurs

on a concrete road for the reason that it gradually gets the water necessary for hydration from rain or snow. However, due to low wearing resistance at early periods, resulting from premature drying, it may be badly worn before rain comes.

An excess of mixing water is a serious fault in concrete. If, in addition to too much water, the concrete is allowed to dry out rapidly it is almost certain to be a failure if subjected to wear and will give very low strength.

Proper curing of concrete is second only in importance to the control of amount of mixing water. Use the smallest quantity of mixing water that will produce a workable concrete, then allow the concrete to have as much water as possible during the period of curing.

Time and Manner of Curing

All concrete should be protected against too early drying for at least one week and longer if practical. During cool weather when the concrete is to be subjected to heavy traffic at an early age, it should be cured for ten days or two weeks.

Covering with damp sand or earth, or wet burlap are excellent methods of curing. The practice of maintaining water over the concrete surface is often employed in road construction. Sawdust is quite frequently employed for covering concrete floors during curing, but this is a dangerous practice due to the probability of sawdust containing organic acids.

EDITORIAL NOTE: For floors, pavements, loading platforms, etc., use sands or screenings from hard, tough, crushed rock or gravel, consisting of quartz, grains or other hard material, graded from fine to coarse with the coarse particles predominating. The coarse aggregate should be one that is clean, hard, tough, crushed rock or pebbles, graded in size, free from vegetable or other organic matter, and should contain no soft, flat or elongated particles.

Hardener for Floor Surfaces

By L. RAY FERGUSON, LE ROY, N. Y.

A hardening solution for concrete floors that prevents dusting is made from sulphate of alumina and acidulated water. This solution has been used by the writer for more than three years on both old and new concrete floors. The method of preparation is as follows:

To ten (10) gals. of cold water (as soft as possible), add slowly one (1) fluid ounce of commercial concentrated sulphuric acid. Heat the liquid to boiling and stir in gradually twenty-five (25) lbs. of commercial powdered sulphate of alumina. When solution has been effected, let cool and settle for several hours. Strain through muslin.

The concrete surface to be treated must first be swept and thoroughly washed. After drying, the hardener is put on, preferably with a broom. Four applications are recommended, three consist of varying dilutions of the hardener with water, while the fourth is the hardener used 100 per cent straight. These first three solutions are, respectively, (1) 30 hardener to 70 water; (2) 50-50; and (3) 70 hardener to 30 water. Allow an interval of 24 hours between successive applications.

The above batch of ten gallons suffices for the complete treatment of an area of from 50 sq. yds. to 100 sq. yds., depending upon the porosity of the surface treated. The total cost of the treatment, exclusive of labor, is 1 ct. to 2 cts. per sq. yd., with sulphate of alumina at 4 cts. per pound. A sp. gr. determination of one lot of the above hardener gave $d = 1.171$ at $22^{\circ}/4^{\circ}$.

Wolverine Portland Cement Company

With \$50,000,000 appropriated by the state of Michigan for road building during 1919, and \$500,000 apportioned to that purpose by the county of Wayne alone, the year promises great activity for the cement industry. In addition, the increased construction of homes and factories seems certain to make the demand for cement greater than in any previous year.

The Wolverine Portland Cement Company, with plants at Quincy and Coldwater, Mich., is well situated to take advantage of this boom in the cement trade. Their Coldwater plant has been equipped recently with new boilers and is now running at full capacity after a shut-down of several months. The average combined output of the two plants is now 2,500 barrels of cement a day. It is understood the company has orders on hand to keep it at capacity production the remainder of the year. Wayne county uses Wolverine cement exclusively in all its construction.

The company was organized in 1902, being the outgrowth of the Michigan Portland Cement Company, organized in 1897. Except for a period of four years, when part of one of its plants was destroyed by fire and while a railroad was being built to its clay beds, the company has been announced as yet for this average dividend of 8 per cent has been paid during the remaining years of its incorporation. At present net earnings are expected to amount to \$8,000 a month, as soon as final improvements are completed.

The company is capitalized at \$1,000,000, all common stock of \$10 par value. There are no bonds. The last dividend was paid in December, 1917, and no dividend basis has been announced as yet for this year. The stock has a book value of well over \$10 a share and the last balance sheet shows a surplus of \$125,000.

The marl cement manufactured by the Wolverine Company is said by the county road building office to be of very good quality. This factor, with the company's newly-equipped plant and a steady demand for cement, should result very favorably for the company this year.

Concrete Products Machine Catalog

The W. E. Dunn Mfg. Co., 414 Twenty-fourth street, Holland, Mich., has issued a very attractive and valuable catalog on its concrete machinery and molds. The book, which contains 72 pages, gives many splendid illustrations. The catalog first deals with the Dunn cement drain tile machines. In these machines the packerhead comes up from below, leaving the casing unobstructed for filling and giving extra packing to the bottoms of the tile, which must support the weight of the whole tile during curing. The No. 1 machine will make 2,000 tile per day, 12 inches long and from 3 to 12 inches in diameter. The Dunn Automatic drain tile machine makes from 3,000 to 3,600 tile per day, 12 inches long and from 3 to 16 inches in diameter. A number of pages are devoted to the Dunn concrete mixers. These are of the cylindrical, open drum type, supported by a hollow cast yoke. They are made in two sizes, 5 and $3\frac{1}{2}$ cubic feet to the batch. Other Dunn products are fence post molds, cement block and brick machines, concrete elevators and conveyors and many different pipes of ornamental molds.

Motor Trucks Open New Regions for Food Supply

To increase the supply of food is one of the most important problems with which we are face to face.

Food must come from the earth. We cannot fabricate the original supply in factories.

We have got to go out in the country and get it. And as facilities improve for getting out into the country to get it, the food supply will increase.

When farmers find a market at a fair profit for anything they produce, they will produce it.

There are thousands of acres of land capable of producing fruit, vegetables and dairy products that are practically undeveloped today because the farmer lacks the transportation to get these products to the market in the limited time necessary because of their perishability.

"It is just this difficulty that the motor truck is overcoming," says R. E. Fulton, Vice President of the International Motor Co.

"Milwaukee, for instance, is getting its milk supply from a radius of 25 miles from the city, due to motor truck transportation.

"Motor trucks privately owned go out and get the milk right off the farm and bring it directly to the city for distribution. There are no delays in shipments and one thing or another as is usually the case in railway transportation.

"The cost of bringing the milk to Milwaukee is 2 cents a can cheaper by truck than by railroad or inter-urban lines.

"The milk comes in 8-gallon cans and with the motor trucks hauling 65 per cent of the 30,000 gallons of milk that come into Milwaukee daily, the saving amounts to \$17,812 a year. In addition to this the milk dealers state that they can handle the milk 5 cents a can cheaper when the milk is brought to them by motor truck from the farms than when they have to go to the railroad station and haul it themselves.

"Time and labor are saved to the milk dealers; and the farmers are out in the fields raising other food while the trucks call for their milk and take it to the market.

"The most popular size of truck in the Milwaukee district is the 3½-tonner.

"Country and city alike are benefitting from motor truck transportation and good roads.

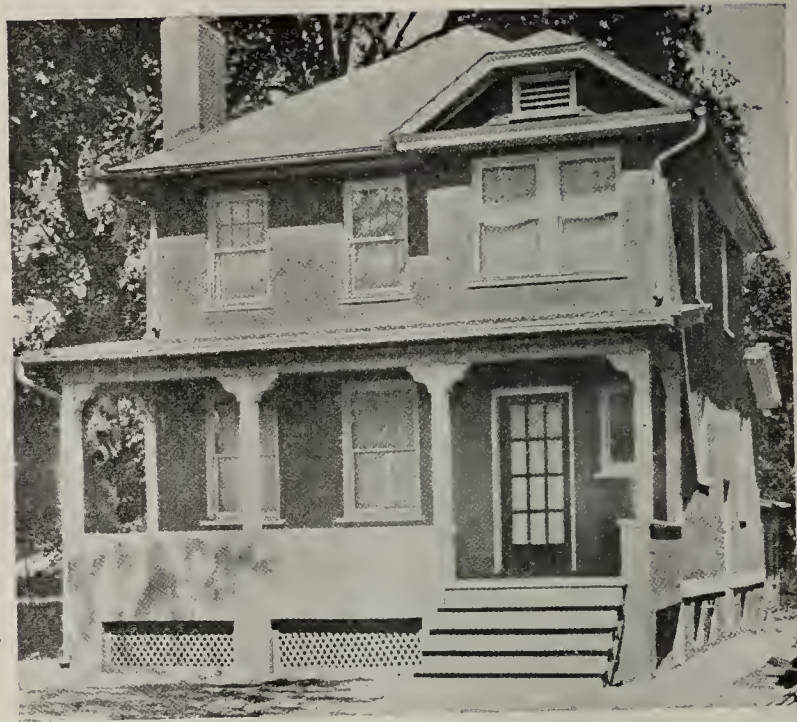
"The source of our food supply depends upon good roads. Given the roads, farmers will produce the food and motor trucks will bring it to market in the quickest and cheapest manner possible."

New Cement House Construction

By William Doyle

A novel method of building construction, never before used in a residence to the builder's knowledge, was executed by me in the erection of three houses at Irvington Avenue, South Orange, N. J., one of which is here shown in Fig. 1.

This is a double construction; an independent outside Portland cement mortar wall giving features of comfort and protection to the dwelling that will appeal to the intelligent home-builder, and at the same cost as wood frame construction, but unlike frame construction it will not deteriorate, but will improve with age. The three houses in South Orange, similar to



Owner—Charles B. Crompton, Irvington Avenue, South Orange, N. J. Builder—William Doyle, 817 Broad Street, Newark, N. J. Details—Residence: Double construction; independent reinforced Portland cement mortar wall. Finish: Natural color stucco.

that shown in Fig. 1, were built for the same price as the architect's estimate for frame construction.

The double construction rests on a concrete foundation, the exterior of which is stuccoed. The frame is erected as in the ordinary frame construction, only, instead of the sill being placed on the outer edge of the foundation, it is kept on the inner edge in order that the vertical reinforcing or steel studs, which re-

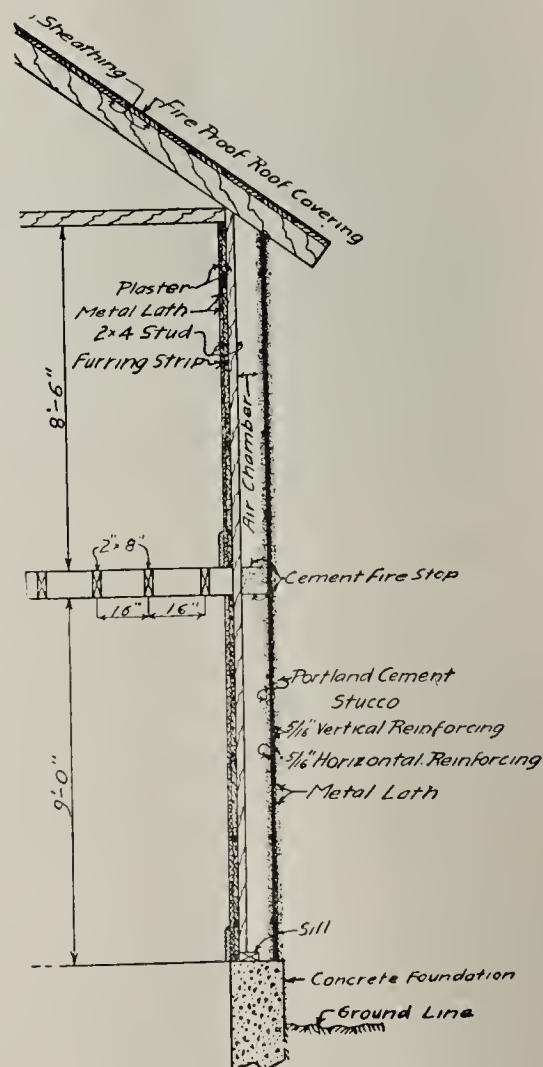


Fig. 2.—Section through stucco wall

inforce the exterior construction, may rest directly on the foundation, as is shown in Fig. 2.

The exterior reinforced mortar wall construction is, therefore, independently rested on the concrete foundation. No form work is necessary for this type of reinforced cement house. The reinforcing consists of rods placed vertically and horizontally, in front of which is fastened expanded metal lath, on which are placed two coats of cement mortar, a scratch coat and a second coat, float finish. The reinforced wall and metal lath are protected by a back plaster coat, making the total thickness of the cement wall about $2\frac{1}{4}$ ". Corner beads are used to facilitate getting a straight line on the house, window corners, and all arrises.

The arrangement, as can be seen by a glance at Fig. 2, provides for an air chamber 4" in depth between the outer and inner walls of the house. The reinforced cement wall is independent of the house proper, there are no joints or joinings. There is absolute elimination of settlement cracks, buckling or warping, because the exterior being reinforced with steel rods both ways, and having no binding contact with the interior, is not affected by interior settlement or shocks, being wholly and entirely independent of the interior construction, its studdings, plastering, flooring, etc.

This construction is simple. In simple language, it amounts to putting a solid cement jacket without a seam around an interior house construction. The house would stand complete as a frame structure, except for the sheathing, were the jacket removed in one piece, as could be done.

This type of construction makes a residence absolutely damp-proof owing to the 4" air chamber. The expense of maintenance of such a house is greatly reduced both for painting and repairs, as this type of construction if properly executed improves with age. The maintenance cost of interior decoration unaffected by dampness is greatly reduced. A building of this description can be heated with less coal in winter, and is cooler in summer, the air chamber acting as a non-conductor.

While in the employ of the Government in the Panama Canal Zone, I was permitted to demonstrate this type of construction in the building of an addition to the medical storehouse at Ancon in 1914, where earthquakes are not uncommon. The building was recently examined by Thomas Flood, an employe of the Government in the Construction Department, and was found to be entirely free from cracks of any kind.

Editorial Note: The method of house construction described by Mr. Doyle is especially suited to industrial housing projects. If there is any plan under way in your town or vicinity providing for the erection of houses for working men and women, it may be possible for you to present this construction to those interested in the project and produce more business for you.

Improved Concrete Floor System

To the Editor of CEMENT AND ENGINEERING NEWS:

I am pleased to comply with your request for a short description of the "Merrick System" of fireproof arch construction recently placed in W. B. Wood & Co.'s new store and warehouse building, Newark, N. J., by the general contractor, Mr. Charles Flocken.

The improvements made in the Merrick System as now being constructed are decidedly new, although the system itself has been in use for some year past.

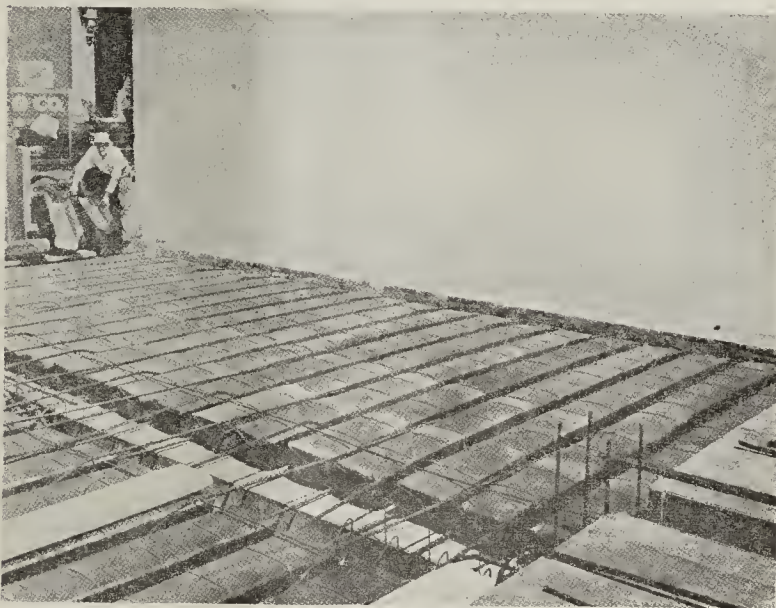
The photo and line drawings shown herewith give such a clear idea of the construction that all contractors, or anyone accustomed to looking at building

drawings, will clearly understand the design and method of installation.

The main point to keep in mind, however, in looking at the drawings, and perhaps the most distinctive feature of this system, is the fact that the ceiling construction is poured and formed in one operation—and at the same time that the top plate is put in. While the system is a "pan system" and uses sheet metal pans much the same as the other pan systems on the market, the casual observer does not notice at first glance that the edges of each pan are held up from the centering forms a sufficient distance to allow the concrete to flow under and form a thin ceiling plate.

Kidder's Hand Book describes this construction as the "upper and lower plate system" and lays emphasis upon the fact of the monolithic construction of the entire floor with large air voids in the center of the arch. Attention is also called to the extra bracing effect given to the side walls of any building in which this system is used.

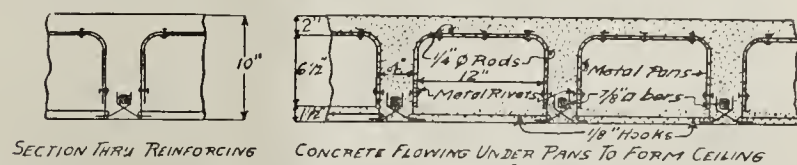
The decidedly new feature that I am using in this particular building is the locking device or "chair" supports for holding the reinforcing steel bars that are



View showing the pans and reinforcing bars just before the concrete is about to be placed to form the floor and ceiling

placed between each double row of pans. It has many advantages. Besides holding the bars in the exact position that they are intended to be held, and figured to be held as shown on the drawings, the improvement facilitates the quick setting of pans and placing the reinforcing bars in position.

All this can be appreciated best by seeing the method in actual operation, and watching the men set each row of pans and handle the bars. It should be noted



that the reinforcing bars are set alternately with each row of pans. The pans are by this means held to a true line, and after the entire floor is set, pans and bars are so locked together that it is impossible to disturb them.

This locking of pans and bars together allows the free handling and spading of concrete, and also allows the formation of the ceiling plate by spading the soft concrete between each row of pans, without the fear of any dislocation of pans or bars. This feature is a very decided advance in the construction of concrete

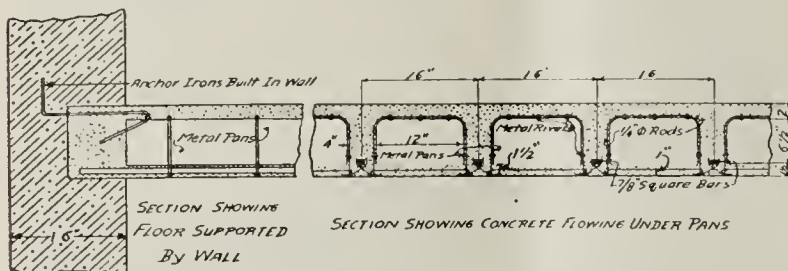
floor arch work, and I think will be appreciated by most contractors who will take the time to investigate the merit of this system.

It should be further noted that the ceiling plate is reinforced every 12 inches with cross connecting $\frac{1}{8}$ -inch wire hooks. These hooks are attached to the lower ends of the $\frac{1}{4}$ -inch round rods that are riveted to the pans. The entire system is thereby locked in every direction, and is reinforced two ways.

The photo shown herewith is for a floor construction figured to sustain a live load of 150 pounds per square foot. For house work and all lighter loads the depth of the arch can be reduced, and the reinforcing bars made smaller.

The Fire Loss

Your suggestion that this system seems to be economical enough to warrant its general use for floor construction in house building, particularly the fireproof construction of the first floor not only in houses but in other buildings, is undoubtedly true. I appreciate also your saying that any new concrete floor construction that has superior points of economy should be put before the public as far as possible in an effort to bring about the more extensive use of fireproof construction. I also note your remarks upon the frightful fire loss that this country suffers each



year—some 9,000 lives and about \$300,000,000 in money values.

I have many times thought of this subject. When you say, however, "economical system," it brings up the question of a definition of terms. There is a "local economy" and there is also a "national economy." Few of us, indeed, think in terms of "national economy" in considering any new building operation. We figure everything out on local figures only. Wooden floors are cheaper to build than concrete floors, figuring on local first cost. At present laws permit use of combustible materials, we keep building with wood, regardless of stupendous national fire loss.

The staggering load of our yearly fire loss will more than pay the interest of the Fourth Liberty Loan. You ask, "Why not make the attempt to save some of this money?" and perhaps you are right in thinking the time is at hand when each individual owner and each architect must necessarily feel it to be a part of his patriotic duty to specify fireproof construction as far as possible in all buildings, and thus do his part in cutting down this fire loss.

The introduction of fireproof construction for houses can best be brought about by each one of us taking into consideration the national aspect of economy in the planning of new buildings. The war taught us many new things in this connection. It has actually revolutionized some of our present methods. We are being forced to economize, and are learning to look at many problems from a different viewpoint. Forced to change many of our present ways, we are surprised to find that the new way is infinitely better. I certainly hope that some of our new ideas in regard to house building will supplant the present custom of "balloon frame" wooden houses.

In our wooden house building we are doing many things in a very extravagant manner. We require

railroads to haul yellow pine lumber all the way from the State of Georgia and other Southern mills to our Northern States, when as a matter of fact right at our very doors is found a better building material. We either do not know this or, knowing it, we do not utilize it.

Concrete is what I refer to. The bulk of concrete is sand and gravel or crushed stone, and they are found in nearly every locality close at hand. In the mixture of 1:2:4 the amount of Portland cement used is only one-seventh of the bulk, and the shipment of this small portion will not burden the railroad service or use an excessive amount of coal in manufacturing the cement.

Concrete is everlasting, and in the hands of workmen who know how to use it, it can be made to take the place of the superstructure, as well as now being used for foundations and cellar walls. Yellow pine and other grades of wood find their true use for interior trim, doors, windows, etc. To use large quantities of wood, however, for the construction of floors, girders and joists is not economical, considered from a national standpoint.

Furthermore, most fires start in the floors. A tabulation of the starting point of fires in buildings shows that the majority of fires originate in the basement, at the first floor level, or near the furnace or heating plant. Of course, after a great conflagration is under way, such as, for instance, the great Atlanta fire of two years ago, the roofs of all adjoining houses are vulnerable points. But the origin of most fires is near the floor construction.

This subject is so pertinent that it is bound to force attention sooner or later. We must do all we can to get architects, engineers, town planners and city councils on our side, and at the very least have laws passed to make the first floor construction of all buildings and dwellings made of fireproof construction.

When the time comes the Merrick Floor System, or some other system equally as good, will be brought into general use.

(Signed) ERNEST MERRICK,
681 Newark avenue, Elizabeth, N. J.

State Sues Cement Companies for Price-Fixing

The state attorney general has filed ouster suits against seven cement companies of Kansas in the state supreme court. According to statements, the suits follow extensive investigations made by the attorney general's office, based on charges that the cement companies have formed a trust, in violation of state laws, to fix cement prices. The petition asks that charters, franchises and business rights of the seven companies be forfeited, that restraining orders against continuing their combination be issued, that the property of all the companies be placed under the control of the court, that receivers be appointed, and finally that each company be fined not less than \$100 for each day it has violated the anti-trust law. The petition charges that the cement companies bound themselves not to sell, manufacture, dispose of or transport cement below a common standard figure which is termed excessive; that the companies have entered into a secret agreement to sell cement in Kansas at a uniform price, and add to said price and charge to the purchaser an amount equal to the railroad freight charges, not from the point of production to the point of delivery, but from the city of Iola, Kan, to the place of delivery, and that the companies agreed unlawfully to divide the territory of Kansas among themselves, to the end that in certain portions of the state certain companies have the exclusive right to fix the price of cement.

Address By Charles Piez, President Link-Belt Company At "Our Country-First Conference"

A National Meeting Held Under the Auspices of the Illinois Manufacturers' Association, Congress Hotel, Chicago, Sept. 9th, 1919.

During the most prosperous period in our history, with the highest wages ever paid, with abundant opportunities for employment, with a universal public acknowledgment of Labor's rights to a fuller and better life, and with an Administration and a Congress most responsive to Labor's demands, we are confronted with a spirit of unrest which threatens the foundation of our social and political, as well as our industrial, structure.

The Great War brought with it such an enormous demand for labor that privileges and concessions that had been the subject of controversy for a generation, were granted without hesitation, simply to insure that continuity of industrial processes necessary to Victory. For it was Victory we were after, even though we had to sacrifice industrial efficiency—yes, the very industrial system itself, to win it.

Our problem was output regardless of cost, and we got it at the sacrifice of those safeguards and restrictions which competition usually imposes on the management of business. Is it strange that with the unlimited opportunities opened up to Labor by the war, it should have become conscious of its political power and its economic strength? Is it strange that Labor should decline to surrender any advantage gained by the war, but should press for the control of industry itself?

If the Plumb Plan is any gauge, then nationalizing the railroads, nationalizing the mines and the industries, does not mean Government ownership and operation in the ordinary acceptance of the word, but purchase out of public funds, with an absolute surrender on the part of the public of every form of control and direction of the employes, without power of revocation. I am referring to the Plumb Plan as a symptom rather than as a possibility, but it shows the character of the malady. And when organized employes of the railroads tie up traffic in four States, and subject the public to loss and discomfort merely for the purpose of influencing a decision in a trolley strike with which the Railroad Administration was in no wise affiliated, it indicates that popular government, if its representatives lack courage, can be absolutely under the domination of an organized, selfish and unscrupulous minority.

I commend the President of the United States, and the Railroad Administration, highly for the sound and courageous attitude taken in the Southwestern railroad strike. But I regret that his position was coupled with a promise to raise wages if the Administration's efforts to reduce the cost of living proved futile. If the high cost of living is due to profiteering by merchants, manufacturers, employes, farmers or workers, then the Government ought to be able to reduce it. But if, as is more likely, investigation proves that the high cost of living is due to economic causes beyond the control of this nation, to world-wide reduction of output to a point far below present world demands, then it will be unwise, to say the least, to meet the situation by a general wage increase, unless that increase is justified by a corresponding increase in effort and output. For if our promise is correct, then the only way out of the difficulty is to produce more and consume less. Nothing else will do.

The railway organizations have evidently abandoned the fairness and consideration of action which characterized them for years, and have forgotten that the control of great power carries with it corresponding responsibilities. The railway employes, no matter what their number, or their power, are not superior to the public and its government, and means along the lines suggested by the Illinois Manufacturers' Association, and covered in our resolutions, should be incorporated in pending railway legislation to protect the public from the results of wanton abuse of the great powers now resting in the hands of these organizations.

I am opposed to government by coercion, by threat and intimidation, because it is subversive of the popular will. I am opposed to the general strike, that un-American instrument of labor oppression, because it attempts to win its point, not by its merit, but by putting an entire community to such inconvenience, trouble and loss that the public will insist on a settlement rather than submit to further pressure.

Certainly such procedure has no place in a democracy, and it will have no place if Mayor Hanson's methods at Seattle be used as a precedent.

New terms have crept into our language that carry with them a threat and a menace. Bolshevism, the dictatorship of the proletariat, the direct actionist, the Soviet, the solidarity of Labor. They are of foreign origin and receive but scant hospitality from American born workmen. I have no fear that Bolshevism will take root here, but I do feel that even the American born workman subordinates himself too readily to the domination of his union leaders, and that he is working on the theory that loyalty to the union, and not loyalty to the public interest, is his first duty.

The union is supposed to be a form of democracy, controlled by the will of the majority; but there are few cases, indeed, in which the free and unrestricted views of the majority prevail. Meetings are subject to the same plays and tricks as political meetings, and rumors of packed meetings, coercion, intimidation, and other misuses of power, are by no means rare.

The meeting hall of the Boilermakers' Union at Seattle is reported to hold nine hundred men. The membership of this Union is said to be fifteen thousand. The vote to strike was taken last January at a late hour by men present in the hall, so that a majority of approximately six per cent of the membership, determined the policy and action of the other ninety-four per cent. And such is the loyalty, or the habit, of the members, that the ninety-four per cent accepted the vote as binding, although private polls of several large groups showed a large majority against the strike. I believe there is no doubt that the Seattle strike was decided upon and enforced by a minority; that it was not the result of a free registration of the will of the majority, after a full discussion. Members of unions will learn sooner or later that it is through such action as that, that confidence in their responsibility to carry out an agreement is lost, and that unionization of industrial processes is looked upon as a step toward business demoralization and ruin, by many employers.

It is to the interest of the sane rank and file of the unions to see to it that pledges and agreements be

kept in both spirit and letter; that methods and practices like systematic reduction of output be discarded, so that public sympathy, which heretofore has been unstintingly given to the aims and aspirations of labor organizations, be not forfeited through wrong and harmful methods.

The unsettled conditions incident to the war, and the general desire on the part of labor to get a large share of the profits of industry, have resulted in some marked reductions of output. I have it on good authority, in two of the large cities of the country, and we may assume this condition to be fairly general, that while formerly from 1,500 to 2,500 common brick laid in the wall per day, depending upon the kind of work engaged in, represented a fair day's work for a bricklayer, today it is impossible to obtain more than from 500 to 1,000 brick laid under the same conditions. While this reduction has taken place over a number of years, the heaviest shrinkage in output has occurred during the past year and a half. And this reduction efficiency is by no means confined to bricklayers, but is characteristic of some of the other building trades as well.

The complete unionization of the clothing industry is being accompanied by an abolition of the piece rate system and by a reduction in the daily output per worker as well. Is it not timely to suggest a national investigation to determine to what extent a reduction of average output has tended to raise the price of certain commodities?

With such evidences as this before us, can we doubt for a moment that the insistence on the continuance of the "open shop" principle in industry is made in the public interest?

Greater production, greater thrift, and frugality are the most effective factors in reducing prices, but increased production cannot be achieved unless wages be based on output instead of on hours worked.

The last two years have witnessed a wide extension of the 8-hour day, and if that has carried with a corresponding reduction in output, and a proportionate increase in pay per hour, a very considerable increase in cost of commodities is accounted for.

I recognize, of course, that the objection of certain unions to piece work is well justified because of past abuses of this method of wage payment, but there can be no question of the fairness and soundness of paying a man for the amount of work turned out, providing the unit or piece rate of compensation is fairly and equitably determined, and its permanency guaranteed. To meet the present urgent demand for increased production we can hardly leave it to the individual operator to determine what output a fair day's work shall represent; for we will sink inevitably to the capacity of the least experienced and least ambitious, for our standard.

Wages based on output, under safeguards that will correct and prevent abuses, should be accepted by organized labor in industries where this practice has been discarded.

There is no doubt that a considerable part of industrial unrest, and its companion, industrial shirking, grew out of the exaggerated notions of profits which the intense industrial activity during the war was supposed to yield. No account was, of course, taken of the outlay for buildings and special equipment which had to be paid for out of profits, nor of the heavy inroads which federal taxes made on the gross return. During the Seattle strike, agitators stated in open meetings that the largest ship yard in Seattle was earning \$60.00 per man per day, out of which the man received \$6.00. The statement was, I was told, widely accepted as rep-

resenting the exact situation, and yet the facts were these: The yard employed 15,000 men, who, according to the statement, earned for the yard the small sum of \$810,000.00 profit per day, or \$250,000,000.00 per year. This represented over four times the total annual output of the yard, and more than two and a half times the value of the contracts held by it. Publicity of the facts is not a bad remedy to apply in such a case.

Another and not an inconsiderable part of present day unrest is due to the nonfulfillment of expectations growing out of the winning of the war. It was predicted that Victory would bring in a new order of things, new social conditions, new relations between employers and employes in industry. Statements of this character were largely idealistic, and referred to an extension of rights and privileges to the downtrodden races of Europe, rather than to any promise of an increase in material advantages to our own citizens. But many people built high hopes on this rhetorical groundwork, and there is naturally keen disappointment that the armistice was not followed by an immediate improvement in the status and income of the individual. This was to be expected. To change from the excitement, the intense interest and the stimulus of war, to the commonplace and comparatively humdrum conditions of peace, required a mental readjustment of our people that could not be accomplished without manifestations of discontent and distrust. It will take time to complete the change, but in the meantime we have a much more critical industrial body to placate and satisfy, and we must look for a remedy to allay unrest and convince the workers they are receiving their fair share of the profits of industry.

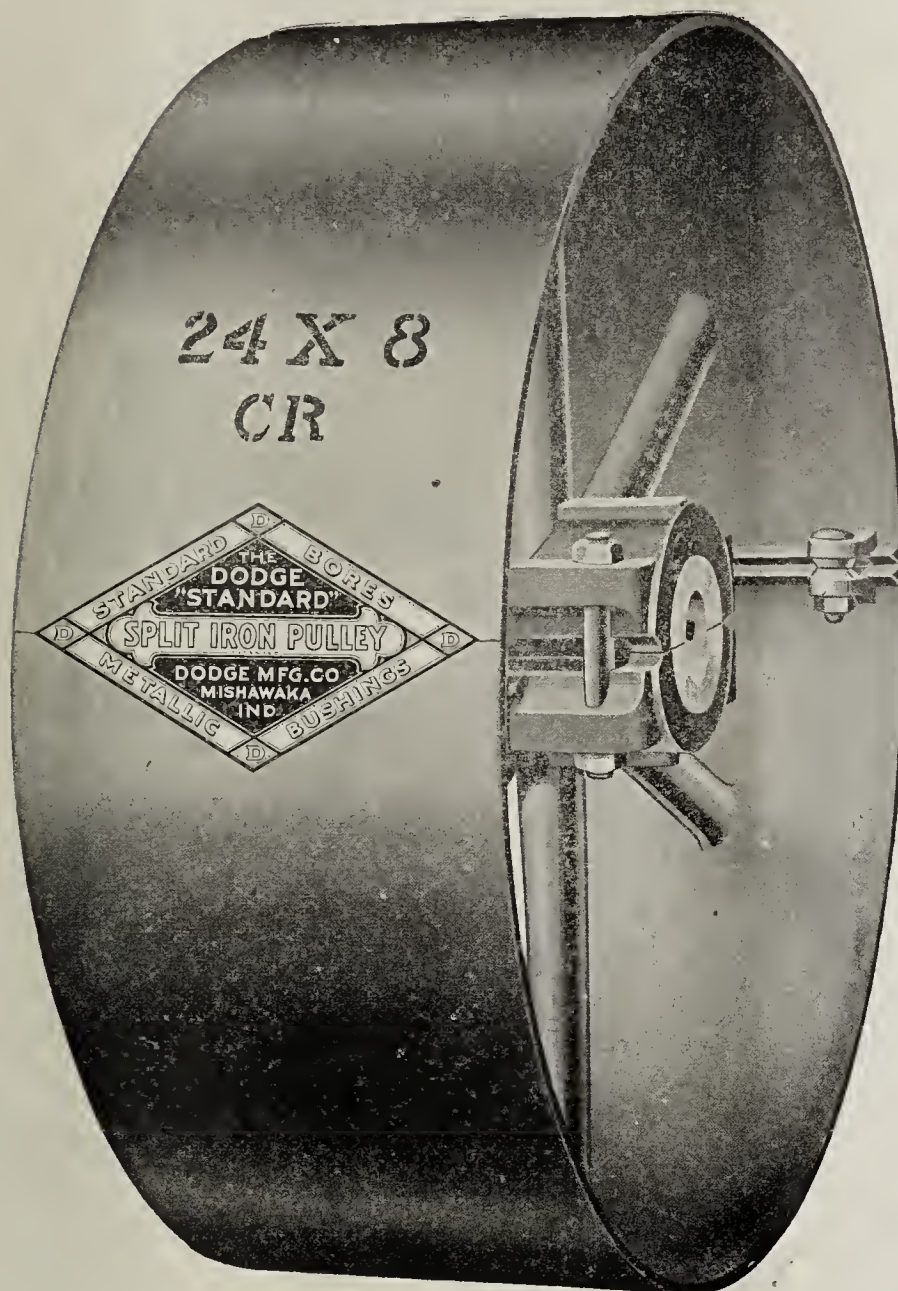
While this conference has not had the time to devote any considerable thought to the industrial problem, it may not be out of place to put before it certain reflections on some of the remedies which are today receiving either consideration or the test of application.

Let us admit in the first place that the industrial problem is a complicated one that will yield to no particular formula, and that where there are so many suggested remedies there is probably no single and specific remedy.

The democratization of industry is glibly spoken of as one of the remedies, and the interpretation placed on this phrase ranges from the establishment of shop committees with authority in matters affecting the employment relations, to the complete control of the industry by the employes. I am not at all impressed with the idea that by democratizing industry we can solve labor difficulties and maintain the health and prosperity of the enterprise as well.

Competitive industry isn't a social or charitable affair, it is a conflict, and leadership is required to bring success. Just as the Nation realized that arbitrary power must be concentrated in the hands of the President of the United States to make the nation's resources and facilities effective in time of war, so to keep industry strong and sound it is necessary to place in the hands of the individual that runs it positive and complete authority. No competitive business that I know of was ever successfully and profitably run by an executive committee or other form of divided authority. Democratization that goes so far as to inject a foreign and discordant element into the management of an industry, that reduces and splits up the authority of the executive (and I believe those to be the aims of the proponents of this suggestion), will either kill industry or reduce it to so moribund a condition that it will have to be kept alive at the public expense.

The prosperity of the country, the opportunities for employment, depend on keeping industry in a strong,



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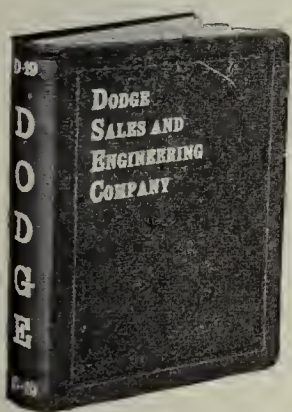
Dodge Iron Split Pulleys are machine molded from metal patterns, carefully finished, faced on the rim and lacquered. Every pulley is absolutely round and in perfect

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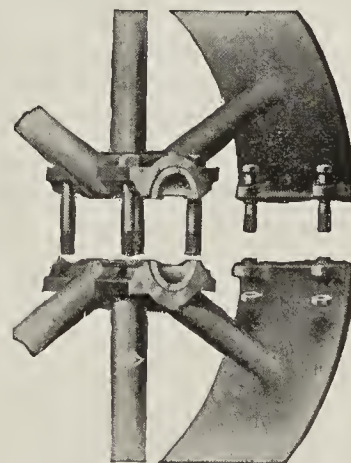
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healthy shape. Co-operative production, a form of completely democratized industry, has been demonstrated a failure. Governmental operation, another form of the same kind of management, has certainly not proved a success. Let us, therefore, resist any experiment or tendencies that will weaken and ultimately destroy the vigor and success of American industry.

Another suggestion to improve the employment relationship has been profit sharing, and new experiments are being tried at every hand. I am highly interested in the results, but as a means of allaying unrest and satisfying the worker, I am afraid most of these experiments are foredoomed to failure. The schemes that succeed will succeed because of the personality of the man behind them, and not because of the merit of the schemes. Profit sharing as it is usually applied, involves payment to the deserving and the undeserving; to the ambitious, energetic, useful employe, and to the laggard who succeeds in just getting by. It is apt to result, therefore, in general dissatisfaction, and a lowering of the standard of efficiency. Many plans have been tried, but a small fraction survive. The profits of the average industry are rarely sufficient to make the amount distributed to the individual large enough to stimulate and retain his interest, and only exceptional industries like that of Mr. Ford can continue to make really effective distribution. I like Mr. Ford's plan, for it consists in paying high wages and insisting that the employes earn them. My own conviction is that the best system for profit sharing consists in the opportunity for earning liberal wages for a standard amount of work performed, and that extra effort and output or extra quality, ought to entitle the man to earn wages in considerable excess of the prevailing rates. This gives the man an immediate additional return on work that is within his own control, and does not force him to wait until the end of the year for an indefinite share in an uncertain profit.

The idea of taking labor into partnership is offered as another remedy. It sounds alluring, but, like profit sharing, is another one of those schemes it is difficult to make workable and permanently effective. In the first place, the average industry, with an investment of, say, \$2,000 per employe, rarely earns in normal times as much as \$1.00 per employe per day. When the return for capital invested is set aside and provision is made for necessary additions and extensions, there is little or no cash to divide, and there is general disappointment among the partners. If any division is made, it must be made in stock, or its equivalent—it can't be made in cash.

Interest in the ownership of a business undoubtedly has a steadying, stabilizing effect, but this interest must be earned through thrift and sacrifice, and not demanded as a right. I will not admit that the success of the industry I am at the head of has been gained at the expense of our wage-earners, that its continued growth has been due wholly to them, and that its capital and surplus have been accumulated by withholding from the men a part of their just earnings.

Our industry, like many other American industries, started through the ingenuity, inventiveness and business sagacity of men who entered a new and untried field. It grew through the thrift and energy of these same men. They weathered its storms, stayed with it through its discouragements, and kept it in the van by the constant addition of new and useful developments, and by the addition of capital for the use of which they mortgaged their future. There are no wrongs to be righted, no redress to make, and no moral justification for turning over title to part of our business to our present wage-earners. I say this in full recognition of the splendid and valuable services ren-

dered by some of our employes, because I feel that full compensation was given, not only for daily tasks performed, but for suggestions and extra services that were useful to the Corporation.

And yet I am strongly convinced that a real pecuniary interest by the employes in an industry is a good thing, provided that interest is paid for. Partnership must carry with it a sense of responsibility in the pecuniary success of the venture, and cannot be helpful or effective if it represents an association in which one partner is purely interested in securing all he can for himself, without thought of the continued strength and success of the venture. I am in favor of opening up the opportunity for acquiring a stock interest in an industry, to every workman whose length and character of service justifies it, and who has the nerve to assume the responsibility to pay for that interest in cash. And when the stock acquired by workmen and employes reached a proper volume, I would gladly welcome a representative of their choosing as a member of the Board of Directors.

Representation on the Board, except on the basis of stock interest, would not and could not bring about the purpose which the proponents of this suggestion have in mind, but would impair, if not ultimately destroy, the very life of the industry.

I believe that the biggest problem industrial management faces today is the labor and production problem; that it transcends in importance the sales and the financial problems, and that it is worthy of the exclusive and direct attention of the chief executive.

Many of the so-called remedies are but substitutes for that direct contact and attention which the chief executive, amid the pressure of other duties, is unable to give. My suggestion to the executives of the industries is to get back in touch with employment, production and wage problems, until a solution, applicable in your case, is found, and delegate to others the supervision of sales, finance, and general policies which now absorb all available time.

Cement in Ireland

There is an unusually fine opportunity in Ireland today for the manufacture of cement. Reconstruction programmes in every country of Western Europe indicate that vast quantities of cement will be used there in the next few years. Cement materials of an excellent quality are found at several points in Ireland and the Secretary of the Dublin Industrial Development Association, writing under date of July 14th, has this to say of its possibilities:

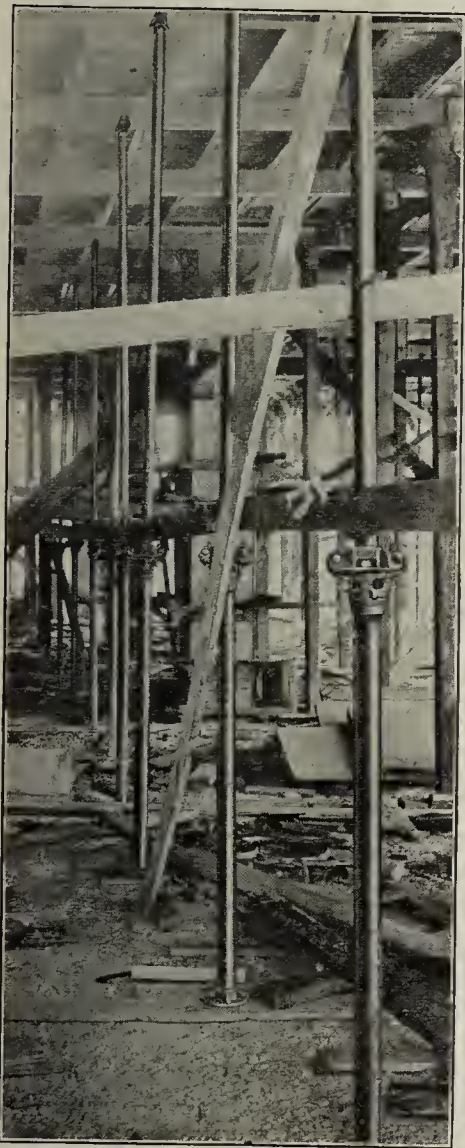
"In at least two districts these materials exist side by side with coal—near Castlecomer and in the Arigna region, Counties Kilkenny and Leitrim, respectively. Analyses of the materials indicate that a product of the highest class is a certainty, given efficient plant and management. The capital required is at least \$1,000,000. I know of a few men who are prepared to raise a portion of that sum as an earnest of their belief in the certainty of success, and then to depute one of their number to go to the United States to put the project before those likely to be interested, and thus make a serious effort to put the manufacture of cement on a sound basis in Ireland.

"There is one cement factory owned by a British combine in Ireland, but most of the product is sold in England or Scotland, and there is ample scope for two or three other modern cement manufactories in the country, while there is a strong feeling of disapproval of permitting a British monopoly to extend its ramifications in Ireland. The Irish architects are prepared to specify Irish-made cement (if of standard quality) for all their work whenever it is available."

Mr. Contractor:

Jiffy Labor-Savers Make Money for You

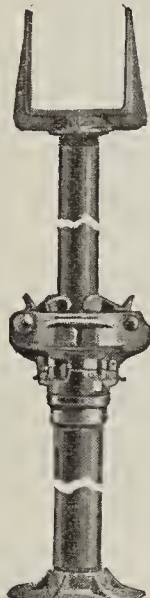
Wood shoring costs approximately $3\frac{1}{2}$ cents per square foot of floor area. **JIFFY ADJUSTABLE JACKS** easily do the same work—and do it better—for *less than 1 cent per square foot*. This saving will help secure contracts.



Jiffy Jacks are here shown making money for Fred Drew, Inc., Woodward Bldg., Washington, D. C., on the Kennedy Apartments. Jacks are set full height under 14-inch floor slab.



Jiffy Double Head Jack for flat slab work.



Jiffy Deep Joist Jack keeps a deep joist from canting.



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Jiffy Panel Jack for temporary work or reshoring.

JIFFY Column Clamp Also Means Bigger Profits

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Provisions of Interest to Manufacturers and Inventors in the Industrial Property Section of the Treaty

The industrial property section of the peace treaty, as appears in the Congressional Record, provides for extension of time for filing applications for foreign patents and for reviving foreign applications or patents which have lapsed during the war in the contracting countries, according to Clarence J. Loftus of Chicago, counsellor in patent and trade-mark causes. Among other things, he says, this section in substance provides:

1. That any time within six months from the coming into force of the treaty, convention applications may be filed in convention countries based upon applications filed subsequent to July 31, 1913. Heretofore it has been necessary to file such applications within twelve months from date of filing application in the home country.

2. That the necessary steps for the prosecution of pending applications can be taken within one year from the coming into force of the treaty.

3. That taxes not paid during the war may be paid now or any time within one year from the coming into force of the treaty.

4. That the failure to work patents in such countries as the law requires working will not forfeit the patent or constitute a ground of revocation of the patent for a period of one year from the coming into force of the treaty.

5. That as to patents in force on August 1, 1914, no working is required for a period of two years from the coming into force of the treaty.

6. That no action can be maintained by German nationals based on the manufacture, sale or use of industrial property rights during the war where such manufacture, sale or use was made by the Government of the allied or associated powers or by anyone acting on behalf or with the assent of such government.

7. That assignments made during the war which might defeat the objects of the present treaty may be considered void by the allied or associated powers.

The Cost of Belt Slip

The Cling-Surface Co., Buffalo, N. Y., in its more than 20 years of existence has done much toward conserving fuel and saving belts by eliminating belt slip. It has made belt slip and its attendant costs and troubles a special study. Readers will therefore be interested in the small and handy accompanying chart and the "Cling-Surface Formula" for more accurately figuring slip costs.

Referring first to the chart, Column B shows roughly how much money Cling-Surface will save.

For example, if you spend \$10,000 per year for fuel (See column A) and if all the power developed is sooner or later transmitted through belting, Column B (opposite the \$10,000) shows that \$300 can be saved by stopping slip.

In the above scale 5% total slip, including creep, is assumed, which is a very low assumption.

If all of the power is transmitted through a main belt and the main belt slips 5%, THE ANNUAL PREVENTABLE LOSS IN THAT ONE BELT IS \$300.

Power is often transmitted from the main shaft to the second shaft, from the second shaft to the third shaft, and so on. This loss multiplies until the total often amounts to 10, 15 or 20% of the yearly cost of the fuel.

In the face of these facts it is evident that the

cost of Cling-Surface is practically "zero" when compared with the money it saves through elimination of slip.

To assist the reader still further in correctly and simultaneously computing slip and costs this formula has been developed:

$$C \left(0.98 - \frac{dn}{DN} \right) = \$ \text{wasted per year}$$

Where—C = Cost of power per year for the given drive dollars:

D = Diameter of driven pulley plus belt thickness, inches

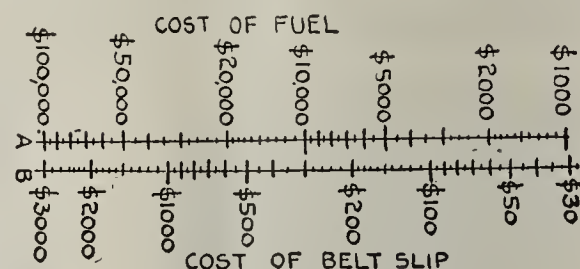
N = R. P. M. of driven pulley.

D = Diameter of driving pulley plus belt thickness, inches

N = R. P. M. of driving pulley.

If the reader doesn't like formulas, it can be done by following these simple rules.

(1) Add diameter of driven pulley to belt thickness,



inches, and multiply by r. p. m. of driven pulley.

(2) Add diameter of driving pulley to belt thickness, inches, and multiply by r. p. m. of driving pulley.

(3) divide (1) by (2).

(4) Subtract (3) from 0.98.

(5) Multiply (4) by the cost of power in dollars per year for the drive.

The result is the dollars wasted per year because of unnecessary belt slip. The function of belt treatment is to save these dollars, an accomplishment that is possible by proper study, care and application.

Excavating and Conveying 500 Yd. of Sand and Gravel Per Hour

A Bucyrus 175-B revolving steam shovel is used by the John C. Rose Sand & Gravel Co., 103 Park Ave., New York, N. Y., in their pit at Marlboro, N. Y., to excavate very hard sand and gravel from the base of a bank 130 ft. high that had previously been undercut by a shovel with a digging radius of only 20 ft. that undermined the bank and left an overhang of about 100 ft. in height that greatly endangered life and property by frequently caving in, sometimes burying the machine and killing the workmen.

This shovel has a large structural iron base mounted on four four-wheel trucks on two standard-gage tracks and carrying a turn-table on which the machine revolves. The 3½-yd. dipper has a 48-ft. handle mounted in a 75-ft. boom that gives a radius of 90 ft. and a cut depth of 60 ft., thus permitting the machine to stand far enough back from the bank to be safe. The bucket is operated under a pull of 60,000 lb. dumping at a height of 52 ft. and a radius of 85 ft into a hopper delivering to a belt conveyor that carries the material to a screening plant that has a capacity of 3,000 yd. a day. The shovel handles two buckets per minute.

The latest improved belt conveyors, washing, screening and crushing equipment are used in this gravel plant. There are two No. 4 and one No. 7½ crushers and a Jeffrey wagon loader.

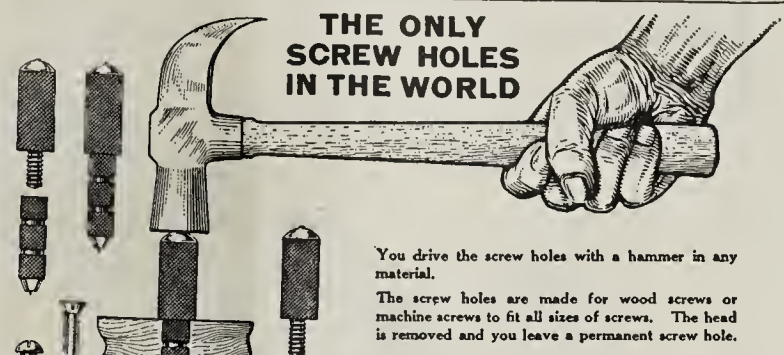
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THE ONLY SCREW HOLES IN THE WORLD

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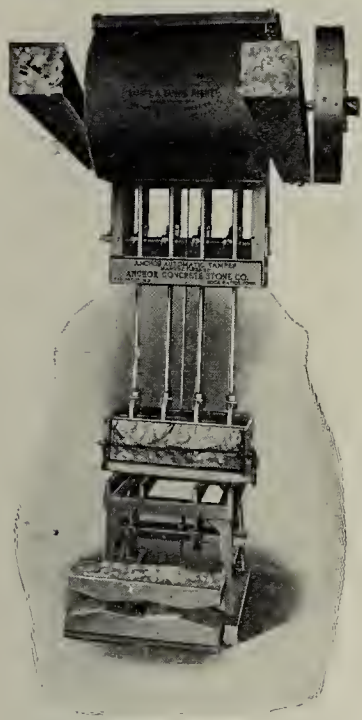
Some of the Reasons Why Screw Holes Will Be Bought and Used and Not Become Dead Stock for Anyone

- 1—They can be used without damage to receiving material.
- 2—They enable you to standardize to wood or machine screws in all material.
- 3—They are made of brass and will not rust under atmospheric or moisture conditions.
- 4—ECONOMY—They save more time value than the holes cost.
- 5—You get them for nothing and are paid for using them when you count time saved.
- 6—Screw holes have been needed ever since the first screw was used.
- 7—Special tools are NOT needed in using them in any material.
- 8—They can be used in any place a screw can be used.
- 9—By using screw holes, screws can be used in many places, and in many materials where it is impossible to use screws without them.
- 10—These are the only ready-made screw holes in the world.
- 11—No special screws are needed. These screw holes fit any wood screw or machine screw now in stock.
- 12—They make the neatest possible job in any material.
- 13—Every store where screws are sold must carry them in stock, because the line of screws is not complete without screw holes for them.
- 14—Every shop and factory where screws are used must also have these screw holes to fit the screws.
- 15—They are endorsed by all dealers in screws and by all users of screws.
- 16—Screw holes are entirely new and the world supply is yet to be furnished.
- 17—This is a progressive Old World of ours, and every active person in it must adopt all improved methods, and all new articles that will help him keep in the front line of progress.
- 18—Be among the first to stock up in screw holes if you are a dealer in screws.
- 19—Be among the first to install screw holes in your shop or factory, as you begin to save money soon as you use them.
- 20—In spite of the high cost of brass, screw holes are yet cheap.
- 21—We are letting the world know that screw holes can now be secured, by means of extensive advertising in all the principal Trade Journals that have the largest circulation among dealers in screws as well as users of screws.
- 22—Do not let your customer ask you for screw holes before you have them in stock. BE A LIVE WIRE.
- 23—They make everlasting holes in any material.
- 24—They mean "Plug-No-More" screw holes.
- 25—They are the result of Necessity being The Mother of Invention.
- 26—Anyone who can drive a nail can use screw holes.
- 27—Send for a sample and convince yourself.
- 28—Mechanics who see them say, "What do you think of that?"
- 29—In fact there are NO REASONS why screw holes should NOT be used.

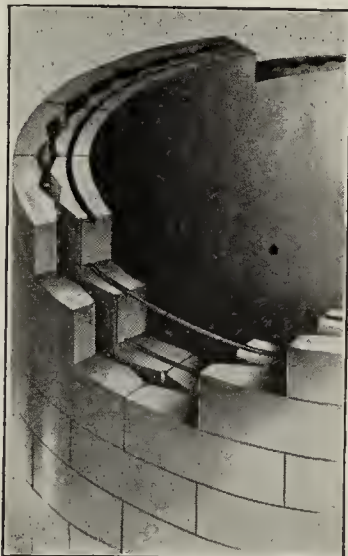
Each of these reasons are enough to sell Screw Holes. There are many other reasons.

Write at once for our handsome Color Card showing screw holes in various materials which will be sent on request, together with samples and price list.

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Anchor Ventilated Corn Crib. Two Blocks made each operation. Each Block 24"x4"x8"

One Anchor Block Machine with a few attachments makes all of the above types of blocks and several others. The same Anchor Tamper tamps them all. Any block with cement connections will conduct frost and moisture. The Anchor Block will not.

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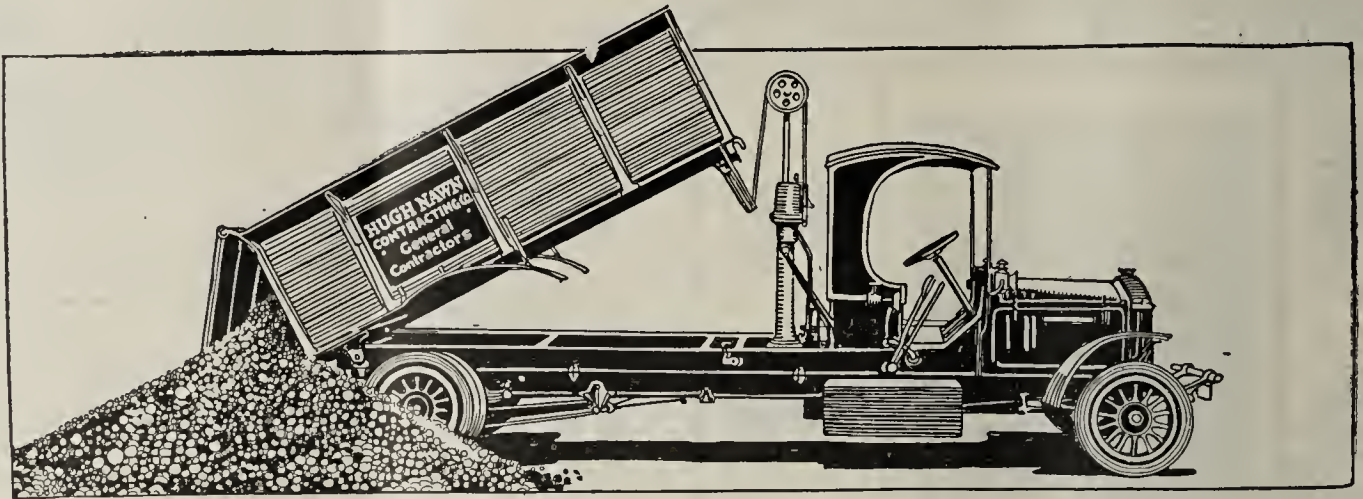
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Hugh Nawn compares year's operating costs for two well-known makes of Motor Trucks

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His choice finally narrowed down to two well-known makes, one the Pierce-Arrow, the other a competitive truck of high reputation. For one year these trucks were kept on similar jobs, both operating under the same accurate system of cost accounting. Neither truck was spared, and the severity of service in rush work is shown by the high tire cost for both trucks. As a result of the comparative showing tabulated below, Mr. Nawn is satisfied that the Pierce-Arrow is the best truck made for contracting business.

COMPETITIVE TRUCK'S RECORD

Miles Run	13,095
Tonnage hauled	10,768
Gallons of gasoline consumed	4,521
Pints of oil consumed	1,176
Repairs to motor	\$740.37
Labor repair cost	249.25
Tire cost	888.79
Year's operating cost excluding insurance, depreciation etc.	3,520.27
Average operating cost per day including overhead	19.80

PIERCE-ARROW TRUCK'S RECORD

15,517 Miles Run	
11,013 Tonnage hauled	
4,389 Gallons gasoline consumed	
385 Pints of oil consumed	
\$136.16 Repairs to motor	
152.91 Labor repair cost	
841.78 Tire cost	
Year's operating cost excluding insurance, depreciation etc.	2,768.96
Average operating cost per day including overhead	16.78

A number of other interesting installations are shown in our booklet, "What Pierce-Arrow Motor Trucks Are Doing In The Contracting Business." We shall be glad to send you a copy.

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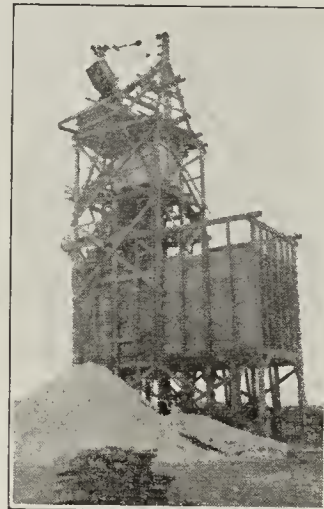
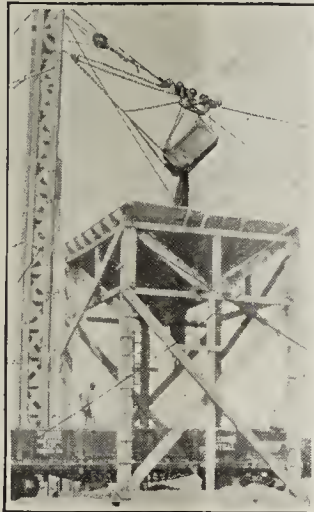
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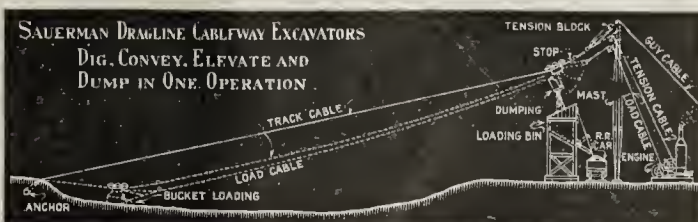
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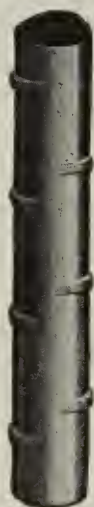
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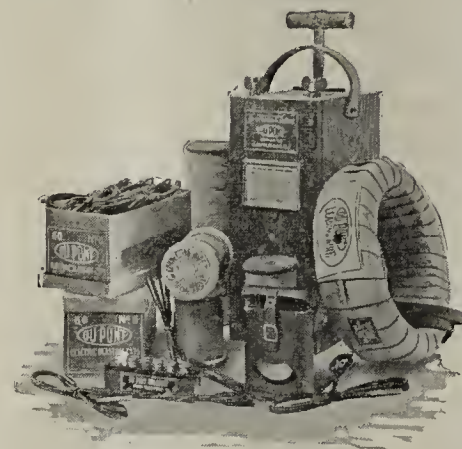
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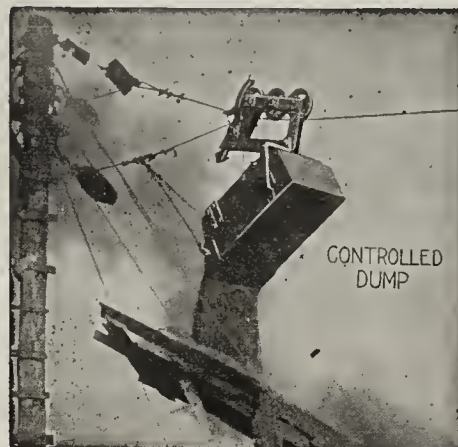
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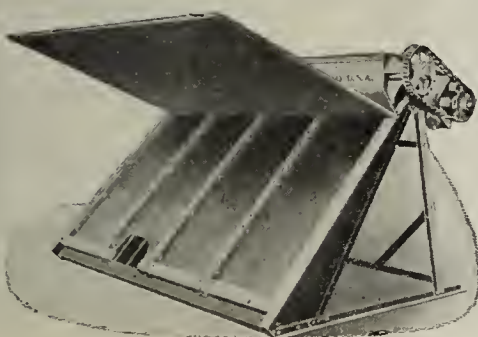
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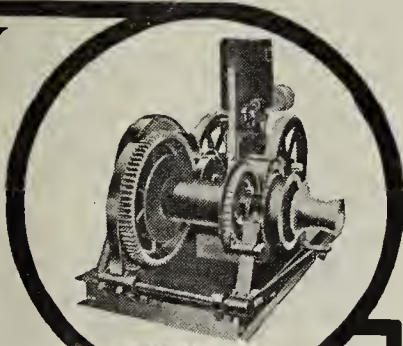
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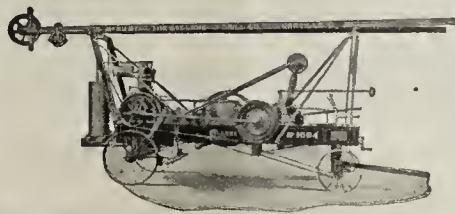


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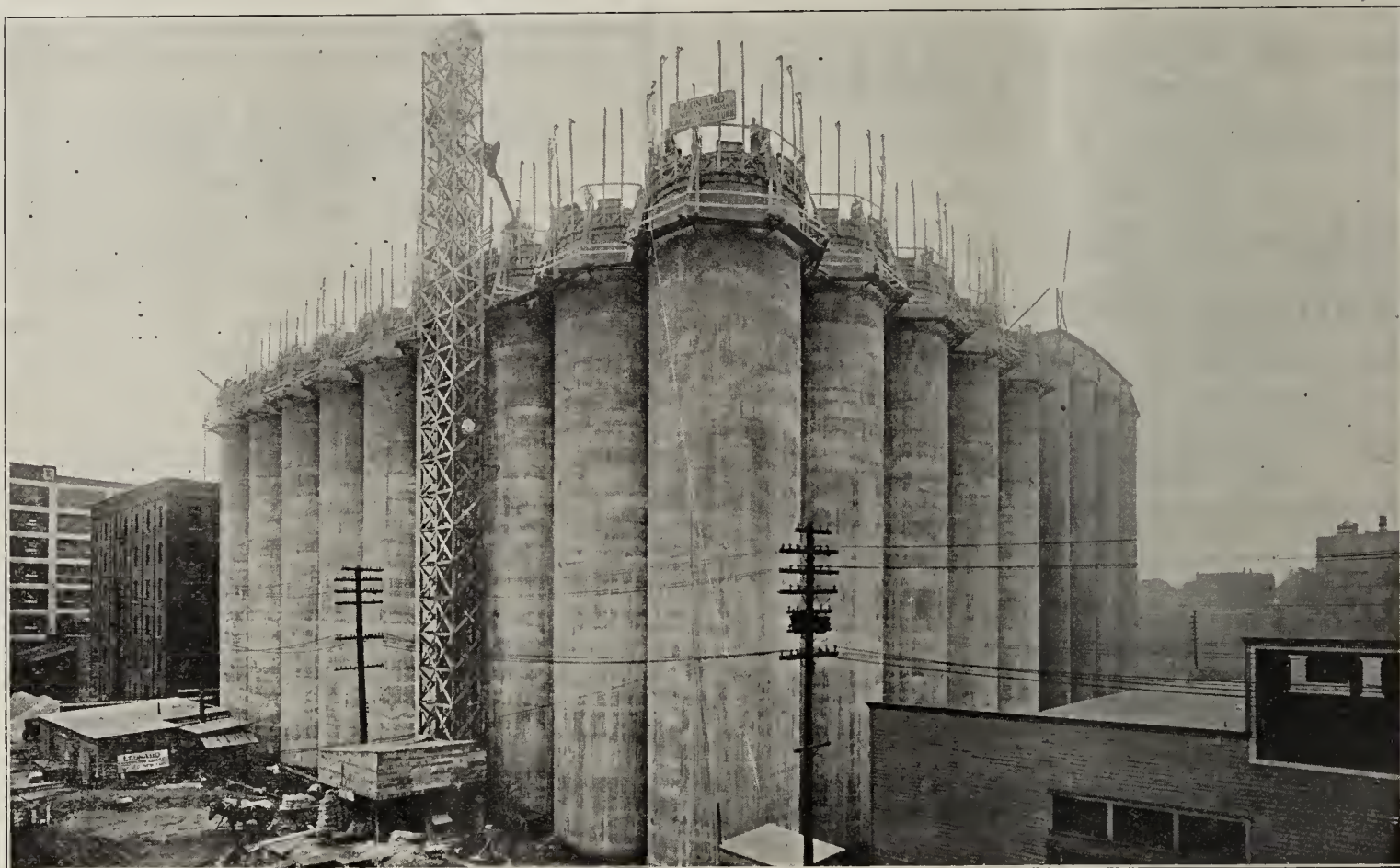
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Belt Conveyor Catalog No. 175-E.

The Jeffrey Mfg. Co.

914 North Fourth Street
Columbus, Ohio

Branches:

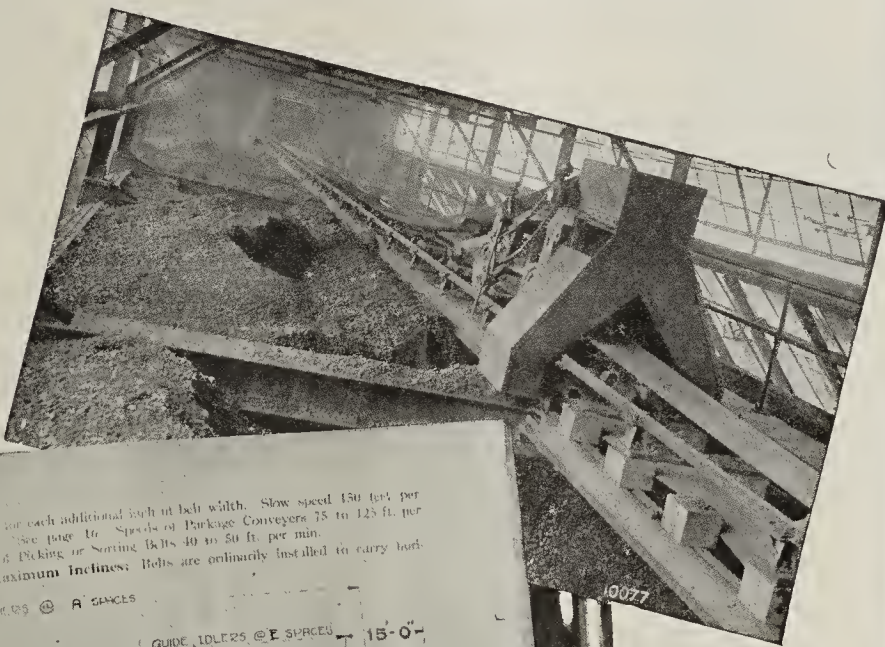
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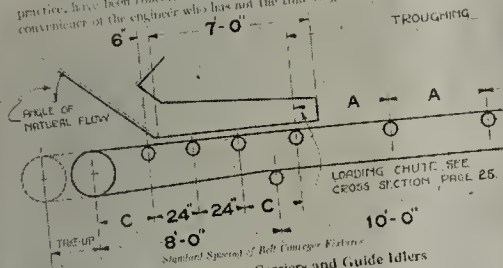
Seattle
Chicago
Montreal

Showing how the JEFFREY Belt Conveyor automatically and uniformly fills large bins or storage space.



A Handy Guide for the Busy Engineer

The following general rules, which embody the best in Belt Conveyor practice, have been collected out of the various pages of this book, for the convenience of the engineer who has not the time to go further into details.



Spacing of Troughing Carriers and Guide Idlers

Width of Belt (inches)	For Materials over 100 lbs. Cu. Ft.	For Materials under 100 lbs. Cu. Ft.	For Sorting, Batching, etc.	C	E
14-16	3'-0"	1'-6"	1'-0"	2'-0"	3'-0"
18-20	4'-0"	2'-0"	1'-6"	3'-0"	4'-0"
24-30	5'-0"	3'-0"	2'-0"	4'-0"	5'-0"
36-42	6'-0"	4'-0"	3'-0"	5'-0"	6'-0"
48	7'-0"	5'-0"	4'-0"	6'-0"	7'-0"

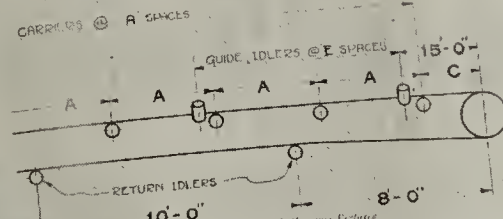
WIDTH OF BELTS: For Loose Materials use at least 4 times the Uniform Size of material handled plus 6 inches or 4 times the Average Sizer Pieces plus 6 inches where such pieces are about 70% or 80% of the whole with the width of the belt in no case to be less than twice the largest pieces to be handled plus 8 inches, where such pieces do not exceed 10% in uniform distribution of all the material carried.

Capacity in Tons Per Hour of materials weighing 50 pounds per cubic foot and carried over Three or Five Pulley Troughing Carriers is approximately 80% of the square of the number of inches in the width of the belt, for each 100 feet of belt speed per minute.

Maximum Speeds of Belts for loose materials equal approximately an initial speed of 250 feet per minute for a ten inch belt, plus 10 feet per an initial speed of 250 feet per minute for a ten inch belt, plus 10 feet per

minute for each additional inch in belt width. Slow speed 150 feet per minute. See page 16. Speeds of Package Conveyers 75 to 125 ft. per minute. Speeds of Sorting Belts 40 to 50 ft. per minute.

Maximum Inclines: Belts are ordinarily installed to carry both



minutely although most materials readily may be carried in a troughed belt at 15° to 20° to the horizontal, many others as high as 21°-23° and some few at 25°. Recommendations covering angles over 20° will be made upon statement of material to be handled, nature in some, and nature of installation. See page 21.

Horse Power Required: Approximately 2% of the number of tons per hour carried for each 100 feet of horizontal belt length and 1% additional for each 10 feet rise of incline. Increase this Horse Power at the belt 5% for each driving reduction thru chain, belting or rat gears and 10% for each reduction thru rough gears to obtain the final Horse Power at Drive Shaft, Motor or Engine. See page 13.

Belt Values: Proper Flexibility in Belts for Troughing Carriers is one ply for each 4 to 5 inches of belt width with 12 inch, 3 ply as a minimum and 48 inch, 8 ply as a maximum in ordinary service. See page 18.

Ultimate Strength of the average Rubber Belt is 360 pounds per inch width of each ply, with a Safe Working Tension of 30 pounds per inch width of each ply. Factor of Safety 12. See pages 12 and 14.

Terminal Pulleys: The diameter of drive pulleys in ordinary good practice is 5 times the number of belt plus with the diameter of all other pulleys taking 180 degrees wrap 4 times the number of plies. See page 22.

Cleaning Brushes: Cleaning brush speeds are ordinarily 800 to 1000 feet per minute at the surface for dry dusty materials; 1000 to 1200 for dump materials; 1200 to 1500 for wet, sticky materials.

Pages 10 and 11 illustrated above are typical. Note the fund of information given at a glance.

Handle it Mechanically

CEMENT AND ENGINEERING NEWS

with which Gravel & Stone Magazine is incorporated

22 Quincy Street, Chicago.

(PUBLISHED MONTHLY)

William Seafert, *Publisher and Editor*J. F. Waldron, *Advertising Manager*R. M. McCully, *Business Manager*

Telephone, Harrison 5397

Cable Address, "Seaferts" Chicago

Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
under Act of March 3, 1879**SUBSCRIPTION RATES:**United States, Canada, Philippine Islands and Mexico, \$1.00 per year; all
other countries, \$1.50 per year.
Single Copies 20c.**DISCONTINUANCES**—The greater part of our subscribers prefer NOT to have
their subscriptions interrupted, in case they fail to remit promptly for renewal.
It is therefore assumed, unless notification is given to the contrary, that the
subscriber wishes to continue taking our paper. Therefore CEMENT & EN-
GINEERING NEWS will be sent until we are notified to discontinue—Such
notice should be sent when the subscription expires.Advertising copy or changes in ads. must be in this office by the 25th of each
month, as hereafter our magazine will appear on the 5th of the following month

Advertising Rates Sent on Application

Vol. 31 CHICAGO, November, 1919 No. 11

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In September another large cement company adopted this mill as a preliminary pulverizer, and another Lehigh Valley cement company started operation of installation.

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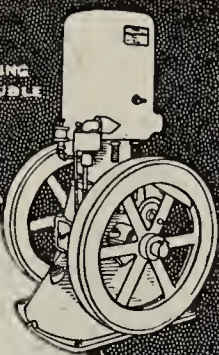
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and look into this question of power. It is worth careful consideration.

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Lansing, Mich.



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storm—the rainbow.

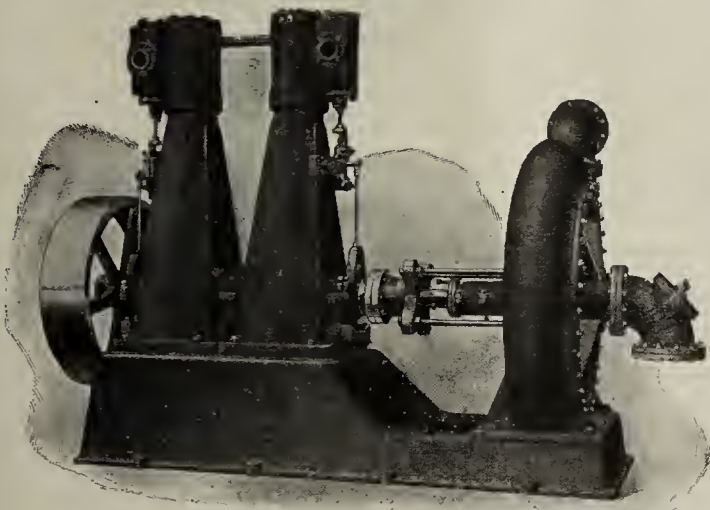
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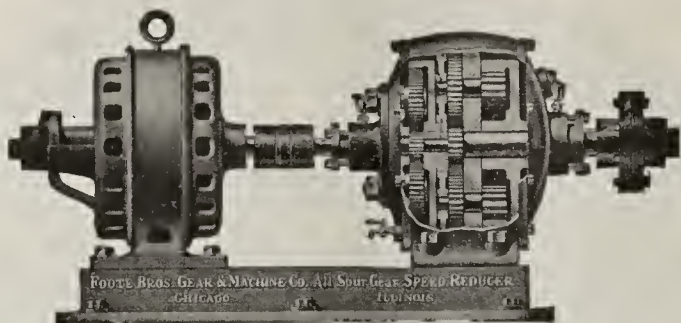
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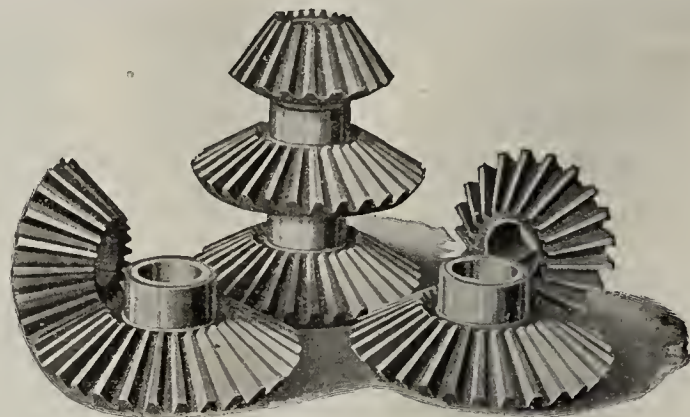
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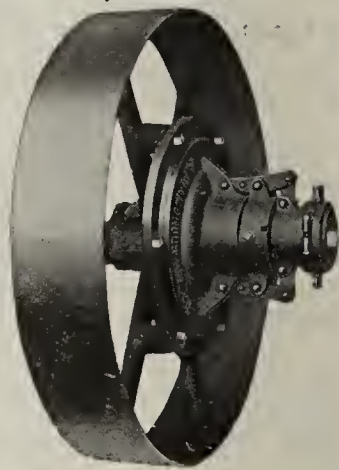
This is only one of the practical advantages the cement mills find in this clutch. Write for our new catalog No. 59 and learn the rest of them.

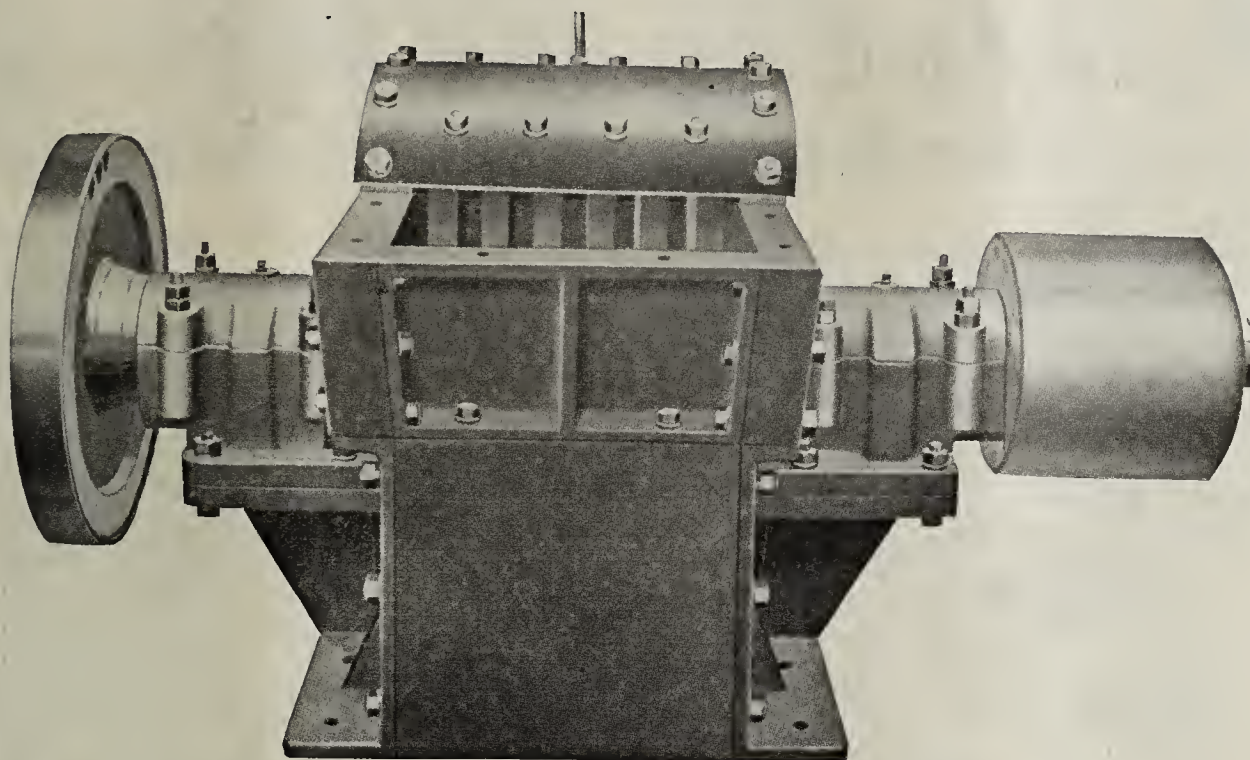
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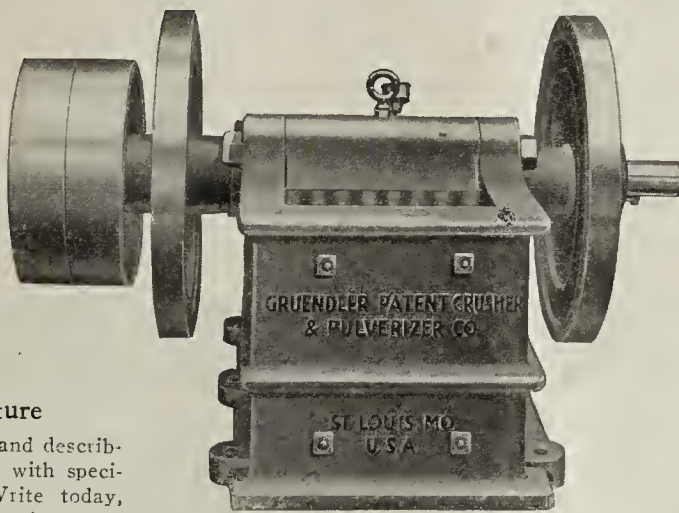
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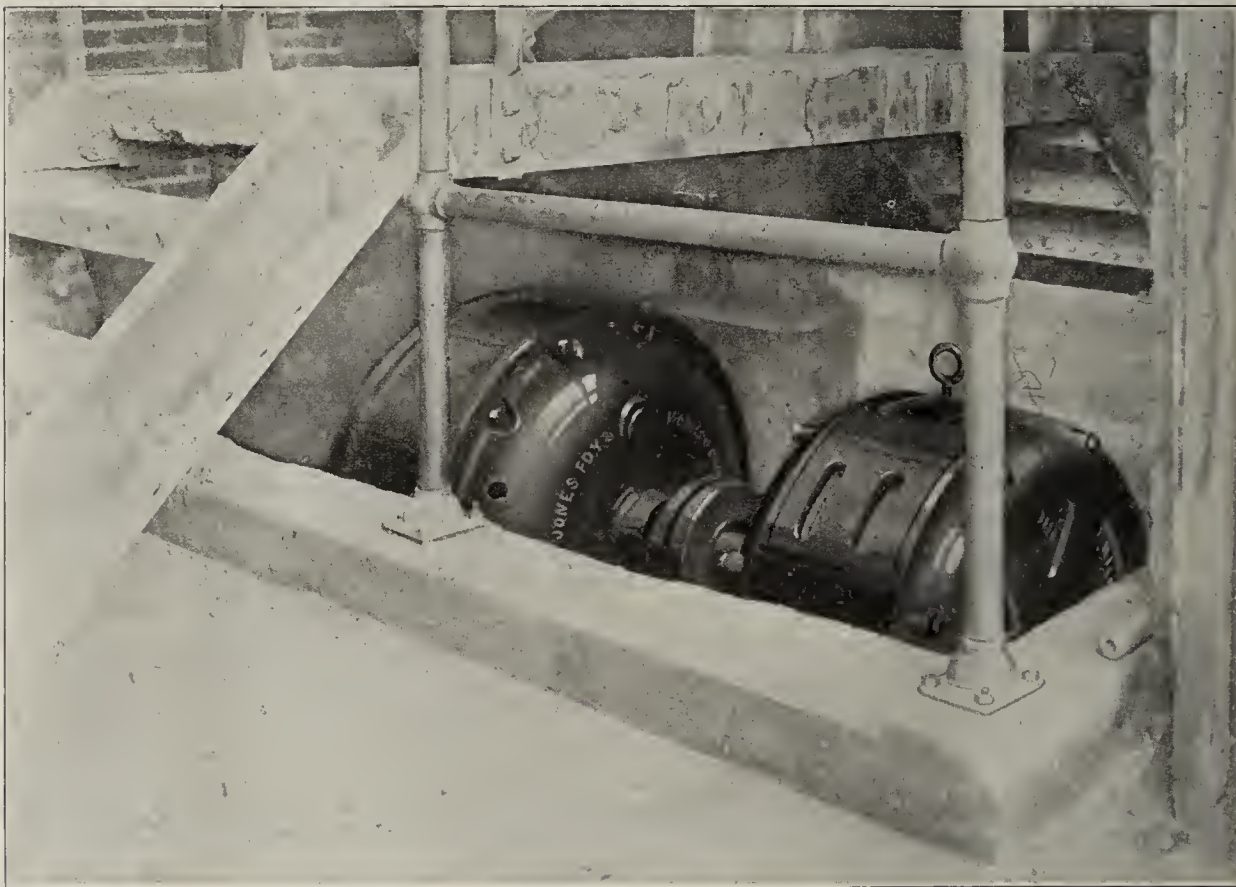


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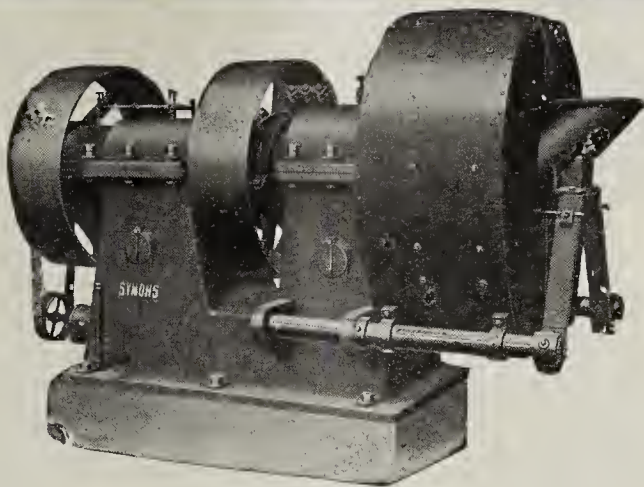
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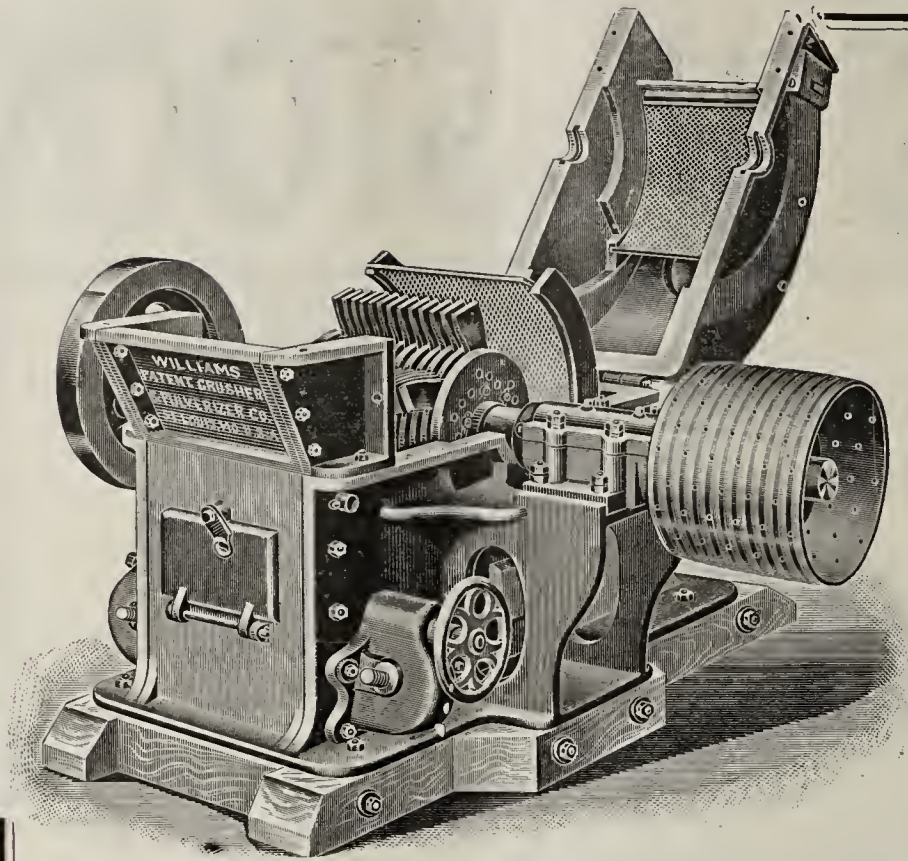
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Already a number have done this, insuring their equipment when needed. We anticipate the demand will be greater than the supply, if some of the orders are not placed this year. We also build Gyratory or Jaw Crushers, Revolving and Pulsating Screens.

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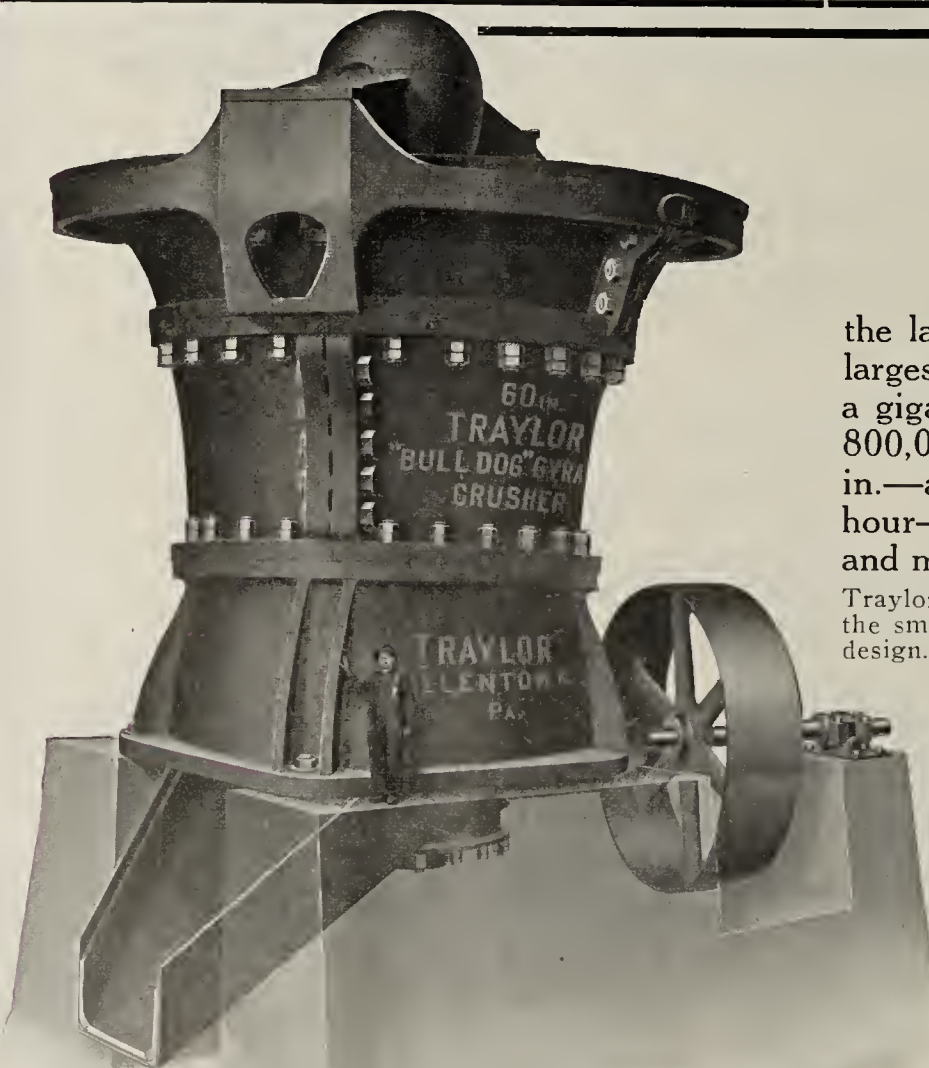
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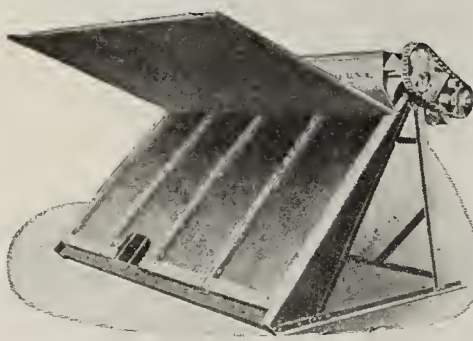
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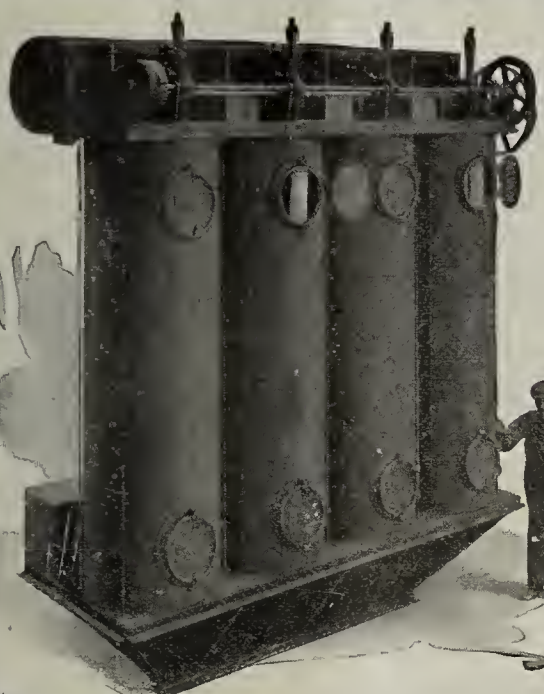
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reduces the efficiency of labor and destroys the working parts of your machinery.

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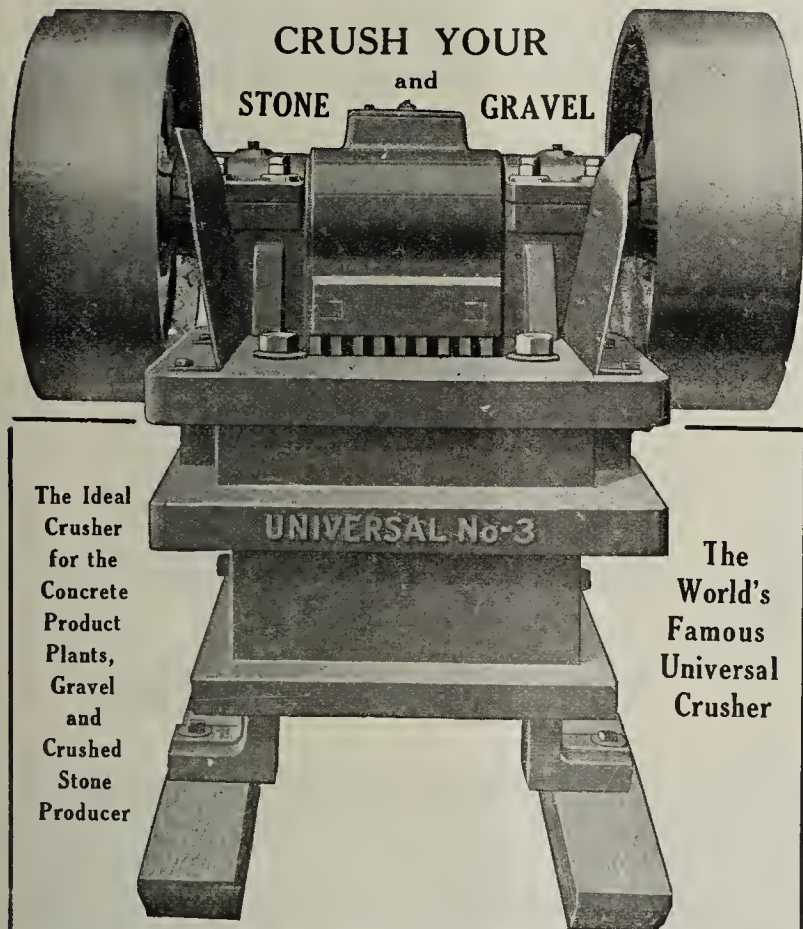
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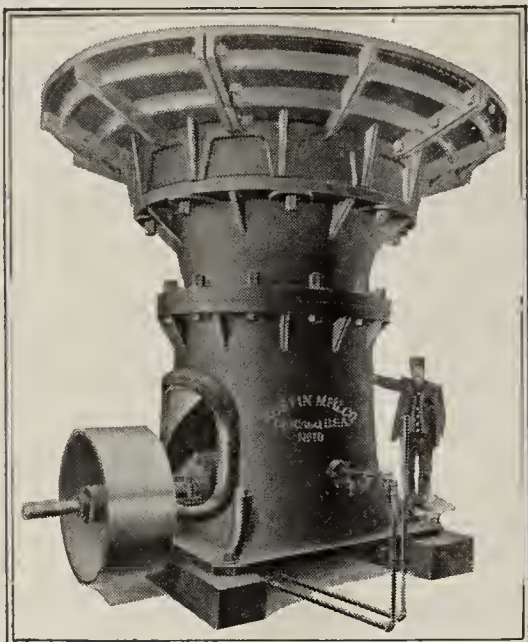
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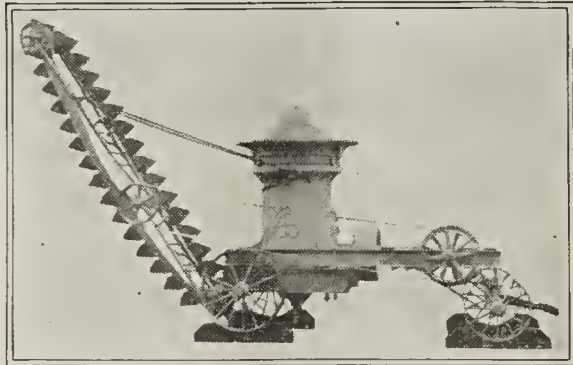
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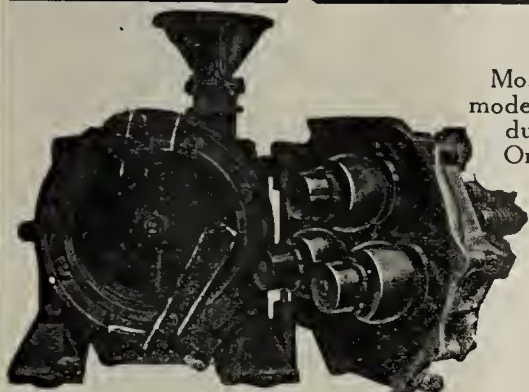
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Ring-Roll Pulverizer

RING-ROLL PULVERIZERS

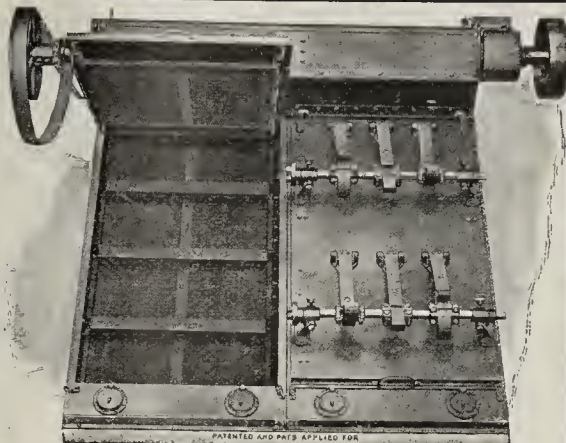
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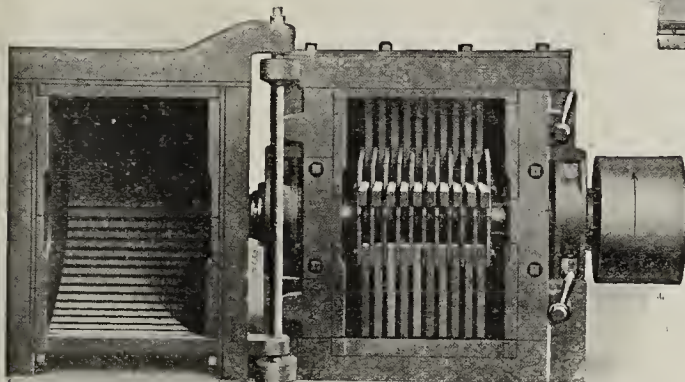


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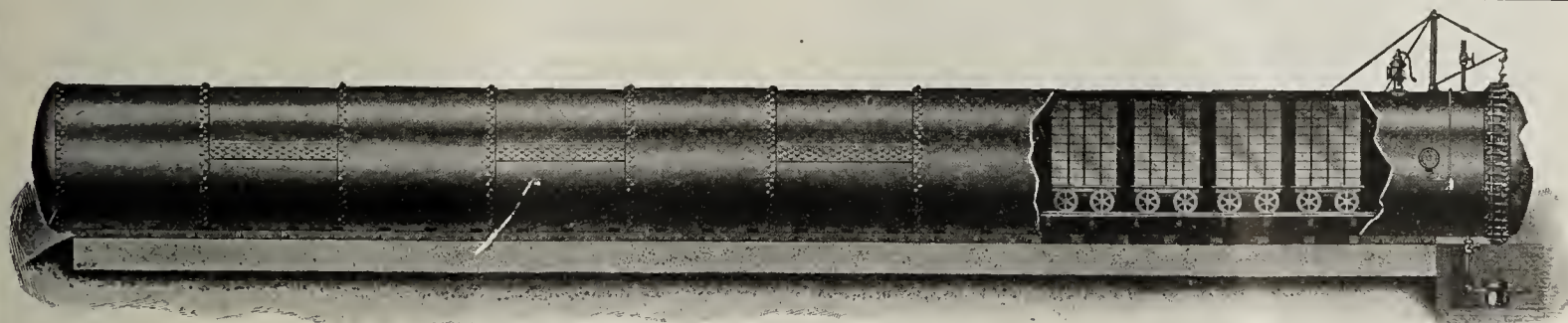
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The screw holes are made for wood screws or machine screws to fit all sizes of screws. The head is removed and you leave a permanent screw hole.

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*Once a Screw
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- 2—They enable you to standardize to wood or machine screws in all material.
- 3—They are made of brass and will not rust under atmospheric or moisture conditions.
- 4—**ECONOMY**—They save more time value than the holes cost.
- 5—You get them for nothing and are paid for using them when you count time saved.
- 6—Screw holes have been needed ever since the first screw was used.
- 7—Special tools are **NOT** needed in using them in any material.
- 8—They can be used in any place a screw can be used.
- 9—By using screw holes, screws can be used in many places, and in many materials where it is impossible to use screws without them.
- 10—These are the only ready-made screw holes in the world.
- 11—No special screws are needed. These screw holes fit any wood screw or machine screw now in stock.
- 12—They make the neatest possible job in any material.
- 13—Every store where screws are sold must carry them in stock, because the line of screws is not complete without screw holes for them.
- 14—Every shop and factory where screws are used must also have these screw holes to fit the screws.
- 15—They are endorsed by all dealers in screws and by all users of screws.
- 16—Screw holes are entirely new and the world supply is yet to be furnished.
- 17—This is a progressive Old World of ours, and every active person in it must adopt all improved methods, and all new articles that will help him keep in the front line of progress.
- 18—Be among the first to stock up in screw holes if you are a dealer in screws.
- 19—Be among the first to install screw holes in your shop or factory, as you begin to save money soon as you use them.
- 20—In spite of the high cost of brass, screw holes are yet cheap.
- 21—We are letting the world know that screw holes can now be secured, by means of extensive advertising in all the principal Trade Journals that have the largest circulation among dealers in screws as well as users of screws.
- 22—Do not let your customer ask you for screw holes before you have them in stock. **BE A LIVE WIRE.**
- 23—They make everlasting holes in any material.
- 24—They mean "Plug-No-More" screw holes.
- 25—They are the result of Necessity being The Mother of Invention.
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- 27—Send for a sample and convince yourself.
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Each of these reasons are enough to sell Screw Holes. There are many other reasons.

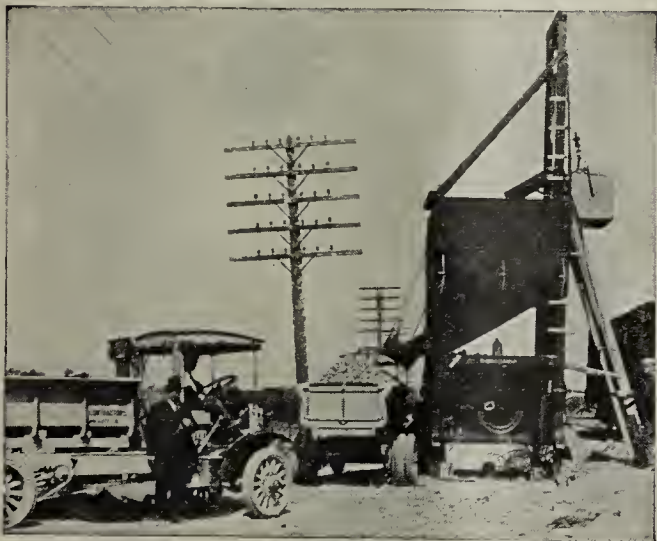
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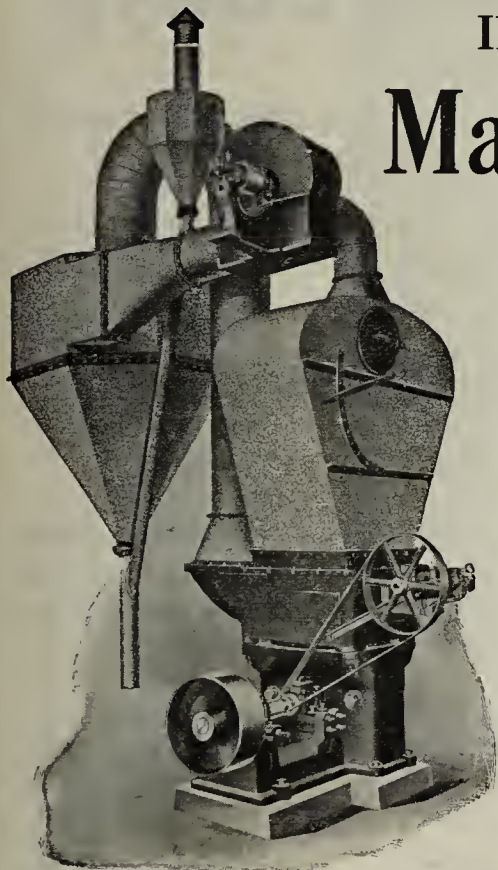
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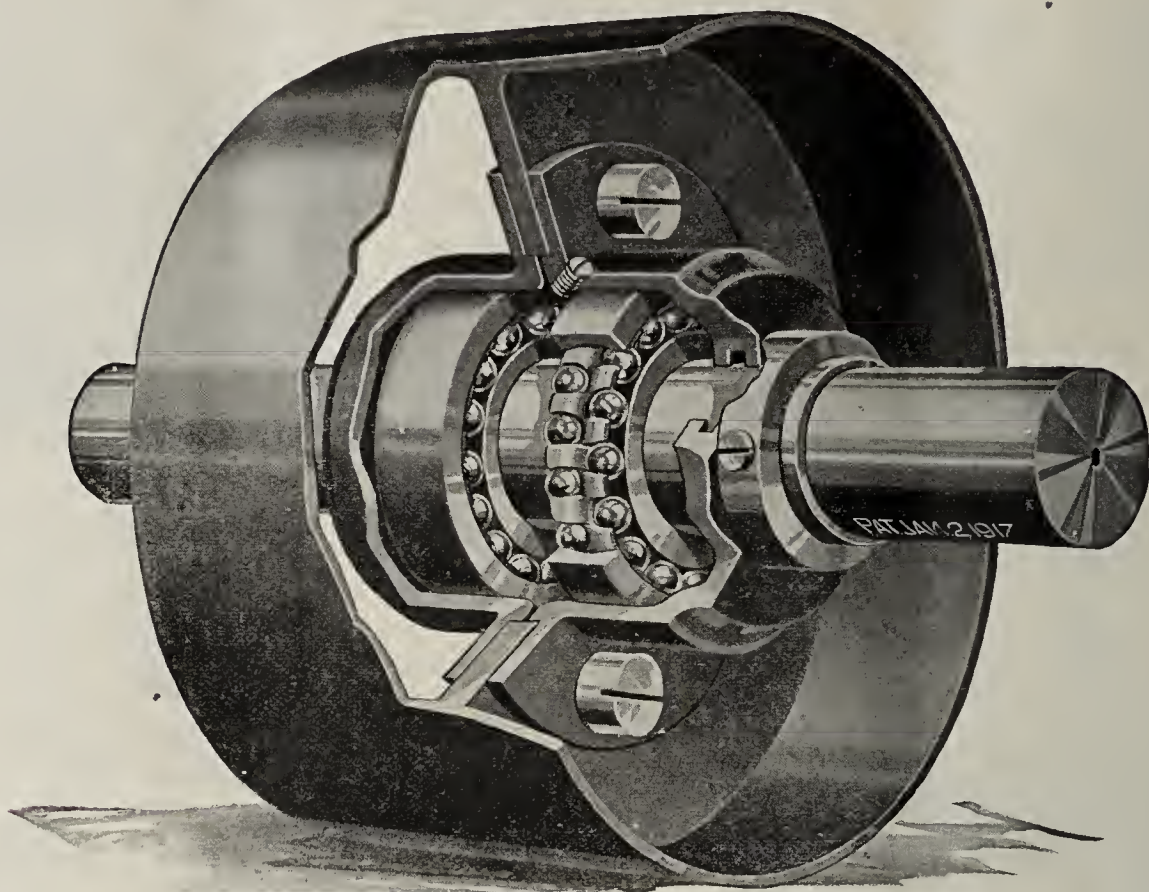
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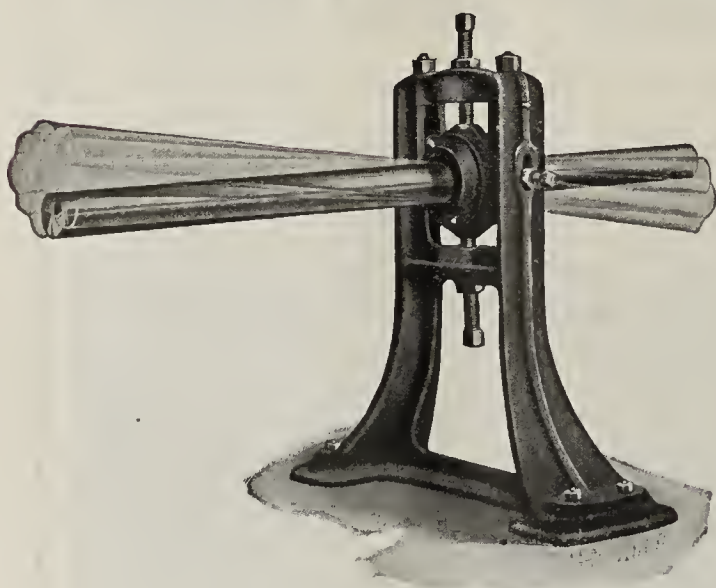
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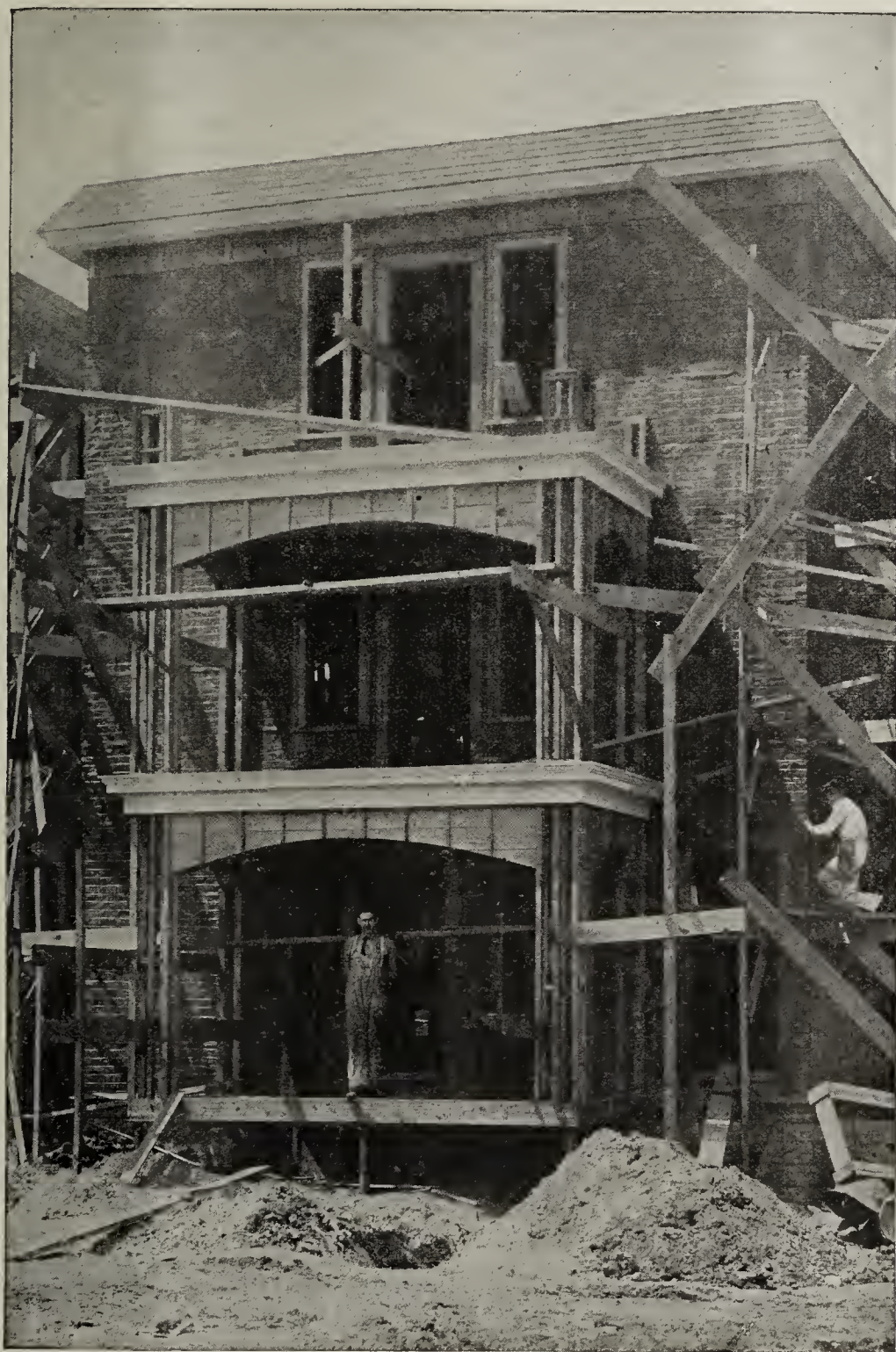
Pioneers in Ball Bearing Power Transmission Appliances.

Cement and Engineering News

Vol. 31

Chicago, November, 1919

No. 11



Cement Stucco House During Construction Showing Frame Work Covered with Wire Lath

Editorial

High Cost of Living Is Traced Back to Deficient Highways

Legislative forces are again on the trail of Old High Cost of Living. These forces are in full swing, with the Senate district subcommittee taking the lead at the National capital.

So far, Old High Cost has had his usual luck in keeping more than a tail's length ahead. His pursuers have been unable to "get anything on him," that is, anything they can tie to.

This last chase started a few days ago when government employes decided they had reached the limit of endurance in trying to keep up with ascending food costs. Their appeals for economic relief reached congress with the result that the hunt for the old villain was on again, and the entire country soon joined in the chase. Already the pursuers are striking the usual conflicting and diverging trails. One scent leads to the packers, another to the butter and egg trust, another to this, another to that.

In all of the hearings and discussions, both in public and private, earnest seekers after the fundamental reasons which underlie the present causes of unrest, find themselves coming out on the same old trail, the unimproved road. It is the profiteer's safe ambush, protecting as it does a long line of cormorants in the form of unnecessary middlemen who are aided in their nefarious work by the devious and unreliable routes to market.

Whatever the remedy proposed, there is always the matter of transportation. Regardless of how many marketing agencies may be brought into operation, or how many restrictions may be thrown around the middleman, no permanent solution can be reached until the road between the producer and consumer is shortened by types of construction that will insure a speedy and open thoroughfare to market under all weather conditions. These are facts that are becoming more deeply impressed upon the legislative mind as high cost investigations proceed.

It is admitted that road building has been given a tremendous boost during the past few years. But even with construction under way practically in every state, such construction is largely in patches, and the process of working out from the neighborhood road to a comprehensive system must necessarily be slow, too slow in fact to meet the economic demands of the hour which are now being so sharply expressed in the cry for lower prices on food.

Farsighted members of congress have had in mind the need for a still greater development of public roads with the result that a bill for a national highway system is now pending in the United States Senate, introduced by Senator Townsend, chairman of the committee on post offices and post roads. It is proposed in this measure to create a nation-wide system of highways under federal control, and maintenance embracing not less than two per cent nor more than five per cent of the mileage in actual use in each state. The location of the federal lines is to be determined by a Federal Highway Commission, after advising with the various state highway departments.

The national system is planned to provide an out-

let or a logical and economical connection with the various state highway systems, the latter in turn to be co-ordinated with county systems. Thus, it is proposed to permanently solve the highway transportation problem in its relation to living costs by providing once and for all a complete system of logically connected and well built highways in order to finally remove the profiteer's chances for covering up his nefarious practices in price juggling on food products, as he is now able to do owing to inadequate lines of delivery from the producer to the consumer.

Advocates of a national highway system are presenting with much force the fact that stabilized living costs will come only with the construction of modern roads upon a co-ordinated county, state and national basis, and that this much desired aim can be achieved best by the government beginning at once on the long lines, while the states build the short lines.

A Combined Steam and Heavy Oil Engine

A great improvement in internal explosion engines has been made in England, in which the piston is forced downward by the explosive mixture in the cylinder, and the same piston is forced up by steam pressure of 220 pounds per square inch, the steam being generated by the heat developed in cylinder in which the fuel is burned or exploded. In the ordinary gasoline engine, the cylinders in which the fuel is exploded are cooled by water circulating around the cylinder. This, however, is a positive waste which is conserved in the new English engine and is usefully applied in generating steam which forces the piston back, making the return stroke a power stroke.

The particular engine to which this new system is being applied is the Diesel which uses heavy fuel oil under a compression of about 500 pounds per square inch. Under this high compression, the fuel charged air and oil are exploded without the aid of the electric spark, sufficient heat being developed, to ignite the charge automatically.

To start the engine, a cylinder of compressed air of 500 pounds pressure or over, delivers its charges of air to the engine until it can act under its own power.

The Diesel Engine is now largely used on ships crossing the ocean, and on war ships of various nations, on account of its greater economy of fuel, and wider range in mileage for the same tonnage of fuel. The steam generated by the cylinder of the Diesel Engine is conducted through pipes to a small boiler. This boiler is not much larger than the engine cylinder. A small flame jet is kept burning under the boiler to prevent the steam from cooling. The steam is drawn off from the boiler, and conducted to the lower portion of the engine cylinder, and forces the piston back on the return stroke under 220 pounds per square inch pressure.

The simplicity of the entire mechanism is to be admired, since no electric spark to explode the fuel charge is required. No incandescent bulb or open flame is used in this engine as a means to explode the fuel charge.—William Seafert.

Fundamentals in the Make-Up of a Concrete Mixture

Thirteen Points Offered by A. N. Talbot Governing the Physical Conditions Which Affect Concrete Making

Clear thinking on the subject of concrete as a material will be helped by a study of the remarks made by Prof. A. N. Talbot of the University of Illinois at the recent annual convention of the American Railway Engineering Association. In discussing the report of the committee on masonry, Professor Talbot said in part:

"Recently I talked with two engineers concerning improvements in making and placing concrete. Both agreed that changes in procedure might be made with advantage. One described a method which he favored, but said it required an artist to carry it out. The other criticised a proposed specification and said it was 'only more of this artists' stuff.' I have no doubt there are many who feel that much of what is proposed for the improvement of concrete is unnecessary and impractical—mere 'artists' stuff.' Familiarity with mixing and placing concrete is likely to breed contempt for rules and regulations, especially when the ill effects of the disregard of proper precautions and workmanlike methods are not apparent to those doing the work. Discussions on how to produce good concrete must add to our information, help to make us better workmen and to secure much better concrete.

"Concrete is a complex product. Many elements enter into development of its strength. As it is well to have some idea of the physical conditions which affect concrete in its making, I have jotted down a number of items which seem to me to bear on the effect of the make-up of the mixture; these are offered as suggestive of the way in which the amount of water used in mixing and the gradation or variation of size of the particles making up the combination of fine and coarse aggregate may be expected to influence the strength of the concrete. These statements may seem elementary; in many respects they are crude. They are presented, however, with the thought that even a general conception of the physical conditions will be helpful in understanding the effect of changes in amount of mixing water and of variations in the size of the fine and coarse aggregate. It is to be understood that there are limitations and qualifications that will not be expressed here. Here are the items:

"1. The cement and the mixing water may be considered together to form a paste; this paste becomes the glue which holds the particles of aggregate together.

"2. The volume of the paste is approximately equal to the sum of the volume of the particles of the cement and the volume of the mixing water.

"3. The strength given by this paste is dependent upon its concentration—the more dilute the paste, the lower its strength; the less dilute, the greater its strength.

"4. The paste coats or covers the particles of aggregate partially or wholly and also goes to fill the voids of the aggregate partially or wholly. Full coating of the surface and complete filling of the voids are not usually obtained.

"5. The coating or layer of paste over the particles forms the lubricating material which makes the mass workable; that is, makes it mobile and easily placed to fill a space compactly.

"6. The requisite mobility or plasticity is obtained only when there is sufficient paste to give a thickness of film or layer of paste over the surface of the particles of aggregate and between the particles sufficient to lubricate these particles.

"7. Increase of mobility may be obtained by increasing the thickness of the layer of paste; this may be

accomplished either by adding water (resulting in a weaker paste) or by adding cement up to a certain point (resulting in a stronger paste).

"8. Factors contributing to the strength of concrete are, then, the amount of cement, the amount of mixing water, the amount of voids in the combination of fine and coarse aggregate, and the area of surface of the aggregate.

"9. For a given kind of aggregate the strength of the concrete is largely dependent upon the strength of the cement paste used in the mix, which forms the gluing material between the particles of aggregate.

"10. For the same amount of cement and same voids in the aggregate, that aggregate (or combination of fine and coarse aggregate) will give the higher strength which has the smaller total area of surface of particles, since it will require the less amount of paste to produce the requisite mobility and this amount of paste will be secured with a smaller quantity of water; this paste, being less dilute, will therefore be stronger. The relative surface area of different aggregates or combination of aggregates may readily be obtained by means of a surface modulus calculated from the screen analysis of the aggregate.

"11. For the same amount of cement and the same surface of aggregate, that aggregate will give the higher strength which has the less voids, since additional pore space will require a larger quantity of paste and therefore more dilute paste.

"12. Any element which carries with it a dilution of the cement paste may in general be expected to weaken the concrete. Smaller amounts of cement, the use of additional mixing water to secure increased mobility in the mass, increased surface of aggregate, and increased voids in the aggregate all operate to lower the strength of the product.

"13. In varying the gradation of aggregate a point will be reached, however, when the advantages in the reduction of surface of particles is offset by increased difficulty in securing a mobile mass, the voids are greatly increased, the mix is not workable, and less strength is developed in the concrete. For a given aggregate and a given amount of cement, a decrease in the amount of mixing water below that necessary to produce sufficient paste to occupy most of the voids and provide the lubricating layer will give a mix deficient in mobility and lower in strength.

"A certain degree of mobility is necessary in order to place concrete in the forms in a compact and solid mass, the degree varying considerably with the nature of the work, and generally it will be found necessary to sacrifice strength to secure the requisite mobility. It is readily seen, however, that the effort should be made to produce as strong a cementing layer of paste as practicable by selecting the proper mixture of aggregate and by regulating the amount of mixing water.

"More thorough mixing not only mixes the paste and better coats the particles, but it makes the mass mobile with a smaller percentage of mixing water, and this less dilute paste results in higher strength. Any improvement in method of mixing which increases the mobility of the mass will permit the use of less dilute paste and thereby secure increased strength."

Causes of Business Failure

Bad luck in business lies not so much in the stars as in the business man himself according to business statisticians. Eighty-six per cent of the business fail-

ures in the United States in 1918 were classed as due to the individual while only 14 per cent were assigned to outside causes. Among the factors of the eighty-six per cent of failures compilers of figures numbered extravagance, lack of capital, and speculation outside regular business.

The Savings Division of the Treasury has pointed out that thrift, savings and safe investment are the antidotes for the toxic virus in the veins of business. Tens of millions of dollars were lost last year through waste of labor and material. Over \$500,000,000 annually is being lost in the United States through speculation in fraudulent stocks. Lack of capital is holding up thousands of enterprises which would go far toward meeting lack of employment and scarcity of production.

Thrift and rigid economy, both business and personal, must replace extravagance if the crisis engendered by the high cost of necessities is to be met. New capital can be produced most easily and most certainly through saving. Safe investment will add to instead of detract from the business assets of the nation.

"Lack of character is one of the chief contributing causes to commercial failure" according to J. Harry Tregoe, secretary-treasurer of the National Association of Credit Men. Thrift saving and safe investment not only are proofs of character but developers of character.

R. G. Dun & Co., reports 4,586 failures involving \$88,941,608 from January 1 to September 30 of this year. It is with the reduction of these figures the increase of production and prosperity in mind that the Savings Division of the Treasury Department is prosecuting its campaign for regular and consistent saving, the elimination of waste and investment in Liberty Bonds.

Cement Production in Oklahoma

Oklahoma is fast becoming a manufacturing state. Scattered over eastern Oklahoma is an abundance of wealth, not only from oil and gas and coal, but also from rocks, sand and asphalt. Already the business of converting limestone and cement shale into commercial cement has become one of the leading industries of the commonwealth, employing more than 1,000 workmen and doing a gross business of several million dollars a year, says the Oklahoma City Journal.

Thus far there are three large plants in the state—one at Dewey, one at Hartshorne and one at Ada. To be exact, there are two at Ada now, a new mill having been constructed recently, though it is under the same management as the other.

Until recently the mill at Dewey was the largest of the three, but the construction of the new unit at the Ada plant places this far in the lead in the state.

Aside from the manufacture of cement the company operating the Ada plant owns and operates a plaster mill at Ideal, Oklahoma, an immense rock crusher at Lawrence and a smaller rock crusher at Webster, Oklahoma.

The capacity of the Ada mill is 5,000 barrels of cement a day. Two processes are used, what is known as the dry process in the older mill and the wet process in the new one. The dry process causes much dust. The entire surrounding country sometimes is covered with the white dust from the crushed limestone. The new process is dustless, the rock being ground in

water, and does not become dry until it reaches the cooking oven.

Inexhaustable Stone Supply.

There is enough limestone near Lawrence, where the Oklahoma Portland Cement Company obtains its supply, to make cement enough to last Oklahoma for a thousand years. In the cooling of the earth's surface, there was pushed up a series of limestone hills across a small part of this county. The hills are really an offspring of the Arbuckle mountains, though between them and the Arbuckle is to be found some fertile farming country. In these hills are billions upon billions of tons of limestone, just the kind for making cement. Then to add to the already favorable situation, there is to be found shale in abundance in close distance. At Lawrence this company takes shale from the top of one hill and then just across the valley gets limestone from the other.

In addition to making cement, this company crushes many carloads of rock daily for the use of the Frisco railway. The crusher is the largest west of the Mississippi river. It will be electrically controlled and operated within a few weeks now. A person will sit in a glass cage, surrounded by levers. He will pull one lever, and a car will move from its resting place and dart down the electric railway. Another lever will move and a giant shovel will begin dumping great rocks into the car. When the car is loaded, still another lever will move, and the load of rock will be rushed over the waiting jaws of a great grinder.

The rock is then crushed, electrically lifted into elevators, carried to another crusher, made smaller, and then is ready to be electrically dumped into the railway cars under the main building.

It all takes only a short time, and only a few men will be needed to man the entire plant. It is said to be the most modern in the world, just as the latest unit of the cement manufacturing here in Ada is said to be the last development in this fast improving industry.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

Of Cement & Engineering News, published monthly at Room 514-515, 22 Quincy St., Chicago, Ill., for October 1, 1919.

STATE OF ILLINOIS, } ss:
County of Cook, }

Before me, a notary, in and for the State and county aforesaid, personally appeared J. F. Waldron, who having been duly sworn according to law, deposes and says that he is the managing editor of the Cement & Engineering News, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, William Seafert, 22 Quincy St.

Editor, William Seafert, 22 Quincy St.

Managing Editor, J. F. Waldron, 22 Quincy St.

Business Manager, F. B. Jamieson, 22 Quincy St.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)

William Seafert, Sole Owner, 22 Quincy St.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities are: (If there are none, so state). None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

J. F. WALDRON,
Managing Editor.

Sworn to and subscribed before me this 23d day of September, 1919.
(Seal.) FRANK W. McVICKER.
(My commission expires January 3, 1920.)

Prices of Cement

History of the Portland Cement Industry Prior to 1913

While three kinds of cement, Portland, natural, and Puzzolan, are produced in the United States, the combined output of natural and Puzzolan cement is now less than 1 per cent of the total production. Puzzolan cement was never an important factor. Natural cement was the chief kind manufactured in the United States prior to 1900. The growth of the Portland cement industry, however, from 300,000 barrels in 1890 to 92,000,000 barrels in 1913, has been excelled in rapidity by no other industry in the United States.

A lowering of the price of Portland cement from \$3 a barrel in 1880 to 80 cents in 1912, made possible by an improvement in technique of production, while the prices of its chief competitors, lumber, brick, and stone, advanced from 20 to 75 per cent, is one of the reasons why Portland cement has gained new uses at the expense of its rivals. The fact that the erection of many small cement structures can be performed largely by unskilled labor has also given cement a great advantage over its rivals. Cement has competed successfully with brick and stone for durable buildings and with lumber for cheap and quickly constructed houses. It has replaced wooden sidewalks entirely and competed with iron and clay for sewer pipe. It has not only become a favorite for new uses such as the building of silos but has also gained foothold in old uses such as shipbuilding.

Portland cement has not only pushed itself into a wider range of uses than its rivals but has gained a far greater territorial scope as well. Unlike common brick, whose chief consumption is in the large cities, Portland cement has won a large market in the farming states for use in silos, barns, bridges, culverts, dams, and aqueducts. While its per capital consumption in 12 densely populated Eastern states was 0.93 barrel in 1916, in four Middle Western states it was 1.39, and in 19 states west of the Mississippi River 1.08 barrels. On the other hand, unlike lumber, cement

was not excluded by fire ordinances from the cities, or limited by the geographical location of its raw materials. As a result of these advantages Portland cement shows a five-fold increase in per capital consumption between 1895 and 1916, while lumber consumption has decreased from 500 board feet per capita in 1909 to 320 board feet in 1916, and brick consumption from 117 per capita in 1905 to 73 in 1916.

The Portland cement industry has attained a greater degree of concentration than obtains in the case of other building materials. The large amount of capital required to equip a cement plant, the uniform character of the product, and the advantage of the wider market have kept the number of cement producers low. There were only 113 cement producers in 1916, as contrasted with over 3,000 brick and tile manufacturers, 4,000 stone quarries, and over 40,000 lumber mills. Concentration was also facilitated by the fact that the American Portland cement industry was at first centered in the Lehigh district of Pennsylvania, which possessed the combination of fairly cheap fuel, abundant supply of the proper kind of limestone, and proximity to large markets. In 1897 the Lehigh district contributed 75 per cent of the total output; but although its output has increased enormously in the meantime it now furnishes only 26 per cent of the total cement production of the United States. Decentralization has come about because nearly every state has the raw materials for making cement, and it is usually more profitable to use local materials than to ship cement from a great distance.

Cement Prices From 1913 to 1918

The decline in cement prices from 1913 to 1914 and 1915 was the result of sharp competition between cement mills with productive capacity over 50 per cent in excess of the output. The subsequent rise in the price of cement from 1916 to 1918 was due to rapidly increasing wages and fuel costs. On the whole, how-

WHOLESALE PRICES OF CEMENT, BY MONTHS, QUARTERS, AND YEARS, 1913-1915.

Portland cement.										Natural cement.
	I. Av. cols. II-VII, incl.	II.	III.	IV.	V.	VI.	VII.	VIII. ^a	IX.	
Market.....	East. & Mid. West. States.	N. Y. & N. Eng. States.	N. Eng. & Mid. West. States.	Ohio, Ind., Ill., Mich.	Ohio.	Ill.	Ind.	N. Y.	West-ern Wash.	Kans., Mo., Okla., Nebr.
Unit.....	Barrel.	Barrel.	Barrel.	Barrel.	Barrel.	Barrel.	Barrel.	Barrel.	Barrel.	Barrel.
Base price.....	\$0.9895	\$1.0808	\$0.9000	\$1.0042	\$1.0270	\$0.9595	\$0.9658	\$1.5800	\$1.3842	\$0.5000
1913—Year.....	.9999	1.0442	.9000	1.0408	1.0406	.9906	.9833	1.5800	1.5218	.5000
Quarters—										
First.....	.9374	.9867	.9000	.9500	.9717	.9217	.8947	1.5800	1.5200	.5000
Second.....	1.0207	1.0200	.9000	1.0833	1.0643	1.0207	1.0257	1.5800	1.6100	.5000
Third.....	1.0314	1.0633	.9000	1.0767	1.0730	1.0370	1.0387	1.5800	1.5600	.5000
Fourth.....	1.0100	1.1067	.9000	1.0433	1.0533	.9830	.9740	1.5800	1.3967	.5000
Months—										
January.....	.8996	.9400	.9000	.9200	.9220	.8950	.8210	1.5800	1.4700	.5000
February.....	.9348	1.0100	.9000	.9300	.9650	.9150	.8890	1.5800	1.6000	.5000
March.....	.9778	1.0100	.9000	1.0000	1.0280	.9550	.9740	1.5800	1.5000	.5000
April.....	1.0137	1.0100	.9000	1.1000	1.0530	.9940	1.0250	1.5800	1.6000	.5000
May.....	1.0267	1.0300	.9000	1.0900	1.0740	1.0340	1.0320	1.5800	1.5000	.5000
June.....	1.0217	1.0200	.9000	1.0900	1.0660	1.0340	1.0200	1.5800	1.5000	.5000
July.....	1.0250	1.0400	.9000	1.0600	1.0600	1.0400	1.0500	1.5800	1.6000	.5000
August.....	1.0310	1.0600	.9000	1.0800	1.0740	1.0290	1.0430	1.5800	1.5600	.5000
September.....	1.0383	1.0900	.9000	1.0900	1.0850	1.0420	1.0230	1.5800	1.5200	.5000
October.....	1.0353	1.1100	.9000	1.0800	1.0660	1.0230	1.0330	1.5800	1.5100	.5000
November.....	1.0995	1.0800	.9000	1.0300	1.0570	.9880	1.0020	1.5800	1.4200	.5000
December.....	.9853	1.1300	.9000	1.0200	1.0370	.9380	.8870	1.5800	1.2600	.5000
1914—Year.....	.9537	1.0500	.9000	.9600	.9830	.9052	.9240	1.5800	1.2750	.5000
Quarters—										
First.....	.9546	1.0733	.9000	.9400	1.0070	.8893	.9180	1.5800	1.3533	.5000
Second.....	.9621	1.0800	.9000	.9567	.9747	.9287	.9327	1.5800	1.2267	.5000
Third.....	.9713	1.0667	.9000	.9800	.9630	.9367	.9513	1.5800	1.2433	.5000
Fourth.....	.9268	.9800	.9000	.9633	.9573	.8663	.8940	1.5800	1.2767	.5000
Months—										
January.....	.9495	1.0600	.9000	.9100	1.0190	.8790	.9290	1.5800	1.3200	.5000
February.....	.9390	1.0600	.9000	.9200	.9860	.8800	.8880	1.5800	1.3400	.5000
March.....	.9753	1.1000	.9000	.9900	1.0160	.9090	.9370	1.5800	1.4000	.5000
April.....	.9753	1.1000	.9000	1.0000	.9940	.9280	.9300	1.5800	1.3000	.5000
May.....	.9560	1.0700	.9000	.9400	.9570	.9280	.9410	1.5800	1.2400	.5000
June.....	.9550	1.0700	.9000	.9300	.9730	.9300	.9270	1.5800	1.1400	.5000
July.....	.9555	1.0600	.9000	.9500	.9640	.9340	.9250	1.5800	1.2400	.5000
August.....	.9757	1.0700	.9000	.9900	.9980	.9420	.9540	1.5800	1.1800	.5000
September.....	.9827	1.0700	.9000	1.0000	1.0170	.9340	.9750	1.5800	1.3100	.5000
October.....	.9670	.9800	.9000	1.0100	1.0060	.9360	.9700	1.5800	1.3500	.5000
November.....	.9492	1.0000	.9000	.9900	.9770	.8840	.9440	1.5800	1.1700	.5000
December.....	.8643	.9600	.9000	.8900	.8890	.7790	.7680	1.5800	1.3100	.5000
1915—Year.....	.8910	.8142	.8292	.9617	.9545	.8821	.9191	1.4525	1.5150	.5000
Quarters—										
First.....	.8550	.8467	.7167	.9167	.9470	.8683	.8350	1.5333	1.3833	.5000
Second.....	.8521	.7767	.6667	.9667	.9447	.8733	.9443	1.3792	1.5233	.5000
Third.....	.9110	.8233	.9000	.9567	.9633	.8863	.9367	1.3958	1.5800	.5000
Fourth.....	.9457	.8100	1.0333	1.0067	.9630	.9003	.9603	1.5317	1.5733	.5000
Months—										
January.....	.8425	.9200	.8000	.9000	.9350	.8790	.6210	1.5800	1.2600	.5000
February.....	.8683	.8500	.7000	.9200	.9550	.8500	.9350	1.5800	1.4000	.5000
March.....	.8543	.7700	.6500	.9300	.9510	.8760	.9490	1.4400	1.4900	.5000
April.....	.8375	.8000	.6500	.9900	.9420	.8730	.9480	1.4000	1.4700	.5000
May.....	.8530	.7500	.6500	.9500	.9460	.8800	.9420	1.4000	1.5600	.5000
June.....	.8638	.7800	.7000	.9600	.9460	.8660	.9430	1.3375	1.5400	.5000
July.....	.9041	.8100	.9000	.9500	.9550	.8750	.9350	1.3375	1.6000	.5000
August.....	.9128	.8200	.9000	.9600	.9720	.8880	.9370	1.3375	1.5300	.5000
September.....	.9161	.8400	.9000	.9600	.9720	.8960	.9380	1.4225	1.6100	.5000
October.....	.9281	.8200	1.0000	.9200	.9600	.9030	.9640	1.4225	1.5100	.5000
November.....	.9610	.8700	1.0500	1.0000	.9900	.8910	.9640	1.4225	1.6100	.5000
December.....	.9480	.7400	1.0500	1.1000	.9390	.9070	.9510	1.7500	1.6000	.5000

^a Bureau of Labor Statistics from New York Journal of Commerce from 1913-1915 and Record and Guide. 1916-1918.

ever, cement prices did not rise as rapidly as the prices of other building materials.

The production of cement was stimulated by the competitive struggle between the various mills, which brought about overproduction and a decline in prices. The production of Portland cement in 1913 was 92,097,131 barrels, almost 10,000,000 barrels greater than that of 1912, which had been greater than the production of any preceding year. In spite of this large production and the business depression of 1914 the production of 1914 was maintained at the high level of 88,230,170 barrels, which was greater than the market could absorb. The stocks of Portland cement, 12,893,863 barrels, at the end of 1914 were the largest in the history of the business.

With production reduced to 85,914,907 barrels and the stocks at the end of 1915 less than at the end of the preceding year, business became prosperous again. Building operations during 1916 were 25 per cent greater than in the preceding years. The cost of cement buildings in the leading cities of the country increased from \$31,000,000 in 1915 to \$51,000,000 in 1916. Under the influence of this heavy demand cement prices rose. Stocks at the end of 1916 were reduced to 8,360,552 barrels. Production in 1916 increased to 91,521,198 barrels and this increase continued throughout 1917, when a new high-water mark of 92,814,202 barrels was reached.

The entry of the United States into the war caused a curtailment of building activity. The resolution of the War Industries Board, March 21, 1918, discouraged building operations during the war and in combination with the scarcity of labor and the high cost of materials reduced the amount of building in 1918 to less than 40 per cent of that in 1916. The decline in the production of cement, however, was not as great as in some other building materials, the output in 1918 falling to only 71,632,000 barrels, or three-fourths of the 1917 production. This was due to the fact that cement was used in the war program to the extent of about

11,000,000 barrels during 1918 for the construction of armories, barracks, gun emplacements, trench linings, bomb-proof shelters, magazines for explosives, sea walls, wharves, dry docks, incinerators, munition factory buildings, warehouses, barges, ships, and even for certain structures in the interior of battleships. The fact that cement manufacturers were limited to 75 per cent of their normal coal requirements did not impose much additional restraint upon production because the decline in building had already curtailed the normal demand for cement.

Cement prices to be paid by the Government were regulated at various times by the Council of National Defense and by the Price Fixing Committee of the War Industries Board from the outbreak of the war, in 1917, to August 24, 1918. The navy had commandeered large quantities of cement early in the war and the prices that were fixed both for the army and the navy were enforced by the penalty of commandeering. The prices fixed on cement to the Government were 30 cents lower than those charged the outside public. The following is the scale of prices per barrel fixed on May 4, 1918:

Hudson, N. Y.	\$1.85	Houston, Tex.	\$1.80
Northampton, Pa.	1.75	El Paso, Tex.	1.95
Universal, Pa.	1.75	San Antonio, Tex.	1.95
Fordwick, Va.	1.70	Trident, Mont.	1.90
Kingsport, Tenn.	1.65	Devils Slide, Utah.	1.90
Richard City, Tenn.	1.65	Brigham, Utah.	1.90
Bellevue, Mich.	1.80	Salt Lake City, Utah.	1.90
Mitchell, Ind.	1.70	Portland, Colo.	1.70
Buffington, Ind.	1.60	Irvin, Wash.	1.95
La Salle, Ill.	1.70	Concrete, Wash.	1.95
Steeltown, Minn.	1.70	Oswego, Ore.	2.00
Mason City, Iowa	1.70	Cement, Cal.	1.95
Iola, Kans.	1.75	Davenport, Cal.	1.95
Hannibal, Mo.	1.70	Crestmore, Cal.	1.95
Harrys, Tex.	1.70		

On August 24 the War Industries Board apparently made a downward revision of the scale of cement prices, reducing the price 3 cents a barrel without bin inspection, and as practically every purchaser demanded it, there was no real change in cement prices. The costs of producing cement were stabilized by the excellent accounting methods that prevailed in the in-

WHOLESALE PRICES OF CEMENT, BY MONTHS, QUARTERS, AND YEARS, 1916-1918.

Portland cement.										
	I. Av. cols. 11-VII, incl.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	Natural cement.
Market.....	East. & Mid. States.	N. Y. & N. Eng. States.	N. Eng. & Mid. States.	Ohio, Ind., West. Mich.	Ohio.	Ill.	Ind.	N. Y.	West-ern Wash.	Kans., Mo., Okla., Nebr.
Unit.....	Barrel.	Barrel.	Barrel.	Barrel.	Barrel.	Barrel.	Barrel.	Barrel.	Barrel.	Barrel.
Base price	\$0.9895	\$1.0808	\$0.9000	\$1.0042	\$1.0270	\$0.9595	\$0.9658	\$1.5800	\$1.3842	\$0.5000
1916—Year.....	1.1132	1.0342	1.0917	1.2000	1.1220	1.1144	1.0929	1.6888	1.5467	.6000
Quarters—										
First.....	1.0367	.9867	1.0500	1.1100	1.0510	1.0450	.9777	1.6700	1.5000	.6000
Second.....	1.1320	1.0733	1.0500	1.1933	1.1457	1.1203	1.1127	1.6700	1.5567	.6000
Third.....	1.1271	1.0533	1.0500	1.2367	1.1440	1.1143	1.1337	1.6700	1.5533	.6000
Fourth.....	1.1570	1.0233	1.2167	1.2600	1.1471	1.1470	1.1477	1.7450	1.5767	.6000
Months—										
January.....	.9981	.9000	1.0500	1.0600	.9790	1.0030	.9970	1.6700	1.3200	.6000
February.....	1.0246	.9700	1.0500	1.1400	1.0370	1.0390	.9120	1.6700	1.6400	.6000
March.....	1.0873	1.0900	1.0500	1.1300	1.1370	1.0300	1.0240	1.6700	1.5400	.6000
April.....	1.1143	1.1300	1.0500	1.1700	1.1460	1.0960	1.0940	1.6700	1.5300	.6000
May.....	1.1418	1.0500	1.0500	1.2000	1.1690	1.1220	1.1260	1.6700	1.5400	.6000
June.....	1.1400	1.0400	1.0500	1.2100	1.1220	1.1430	1.1180	1.6700	1.6000	.6000
July.....	1.1155	1.0500	1.0500	1.2000	1.1350	1.1360	1.1190	1.6700	1.5600	.6000
August.....	1.1298	1.0600	1.0500	1.2500	1.1450	1.1360	1.1350	1.6700	1.5300	.6000
September.....	1.1361	1.0500	1.0500	1.2600	1.1460	1.1640	1.1470	1.6700	1.5700	.6000
October.....	1.1408	1.0200	1.1500	1.2300	1.1500	1.1560	1.1390	1.6700	1.5200	.6000
November.....	1.1480	1.0400	1.2500	1.2500	1.1170	1.1270	1.1040	1.6700	1.5700	.6000
December.....	1.1823	1.0100	1.2500	1.3000	1.1760	1.1580	1.2000	1.8950	1.6400	.6000
1917—Year.....	1.4401	1.3358	1.4750	1.5725	1.4472	1.3975	1.3383	2.0942	1.7158	.6500
Quarters—										
First.....	1.3025	1.1867	1.4000	1.3867	1.2947	1.2930	1.2873	1.9867	1.6333	.6500
Second.....	1.4636	1.4033	1.5000	1.6033	1.4453	1.4100	1.4163	2.1500	1.6667	.6500
Third.....	1.4962	1.4100	1.5000	1.6567	1.4530	1.4557	1.5020	2.1200	1.6533	.6500
Fourth.....	1.4979	1.3433	1.5000	1.6433	1.5957	1.4313	1.1477	2.1200	1.9100	.6500
Months—										
January.....	1.2360	1.0800	1.3500	1.3600	1.2180	1.2410	1.1670	1.9200	1.6000	.6500
February.....	1.3020	1.1900	1.3500	1.3700	1.2870	1.2960	1.3180	2.0200	1.6200	.6500
March.....	1.3696	1.2900	1.5000	1.4300	1.3700	1.3420	1.3770	2.0200	1.6800	.6500
April.....	1.4400	1.4000	1.5000	1.5400	1.4420	1.3770	1.3720	2.1500	1.6300	.6500
May.....	1.4517	1.4100	1.5000	1.5700	1.4240	1.3980	1.4130	2.1500	1.7400	.6500
June.....	1.4990	1.4000	1.5000	1.7000	1.4700	1.4600	1.4640	2.1500	1.6300	.6500
July.....	1.5028	1.3900	1.5000	1.7100	1.4730	1.4410	1.5030	2.1200	1.6500	.6500
August.....	1.4935	1.4200	1.5000	1.6800	1.4380	1.4650	1.4770	2.1200	1.6300	.6500
September.....	1.4925	1.4200	1.5000	1.6800	1.4480	1.4610	1.5260	2.1200	1.6800	.6500
October.....	1.5036	1.4300	1.5000	1.6100	1.5060	1.4860	1.4900	2.1200	1.8100	.6500
November.....	1.5103	1.3700	1.5000	1.6500	1.6010	1.4050	1.5360	2.1200	1.9700	.6500
December.....	1.4798	1.2300	1.5000	1.6700	1.6800	1.4030	1.3960	2.1200	2.1500	.6500
1918—Year.....	1.6671	1.6733	1.8333	1.7633	1.6374	1.5500	1.5453	2.3869	1.8742	.8500
Quarters—										
First.....	1.5532	1.5300	1.6330	1.7000	1.5150	1.4933	1.4467	2.1475	1.8633	.8500
Second.....	1.6877	1.6333	1.9000	1.7567	1.6837	1.5787	1.5740	2.5077	1.9800	.8500
Third.....	1.7064	1.7300	1.9000	1.7667	1.6837	1.5810	1.5973	2.6923	1.8566	.8500
Fourth.....	1.7209	1.8000	1.9000	1.8300	1.6673	1.5650	1.5630	3.2000	1.7967	.8500
Months—										
January.....	1.5011	1.5400	1.5000	1.6700	1.4930	1.4140	1.3900	2.1425	1.9300	.8500
February.....	1.5130	1.5000	1.5000	1.7200	1.4240	1.4940	1.4320	2.1500	1.7300	.8500
March.....	1.6457	1.5500	1.9000	1.7000	1.6280	1.5780	1.5180	2.1500	1.9300	.8500
April.....	1.6510	1.5500	1.9000	1.7000	1.6680	1.5690	1.5190	2.3500	1.9900	.8500
May.....	1.7050	1.6300	1.9000	1.8000	1.6960	1.5730	1.6310	2.3660	2.0000	.8500
June.....	1.7071	1.7200	1.9000	1.7700	1.6870	1.5940	1.5720	2.5925	1.9500	.8500
July.....	1.6917	1.7200	1.9000	1.8000	1.6600	1.5870	1.5330	2.6000	1.8500	.8500
August.....	1.7191	1.7200	1.9000	1.7600	1.7110	1.6560	1.6360	2.6000	1.9300	.8500
September.....	1.7085	1.7500	1.9000	1.7600	1.6900	1.5580	1.6030	2.9000	1.7900	.8500
October.....	1.7058	1.8000	1.9000	1.7600	1.6770	1.5580	1.4800	3.2000	1.9100	.8500
November.....	1.7463	1.8000	1.9000	1.9400	1.6700	1.5690	1.5810	3.2000	1.7400	.8500
December.....	1.7105	1.7400	1.9000	1.7900	1.6370	1.5680	1.6280	3.2000	2.1400	.8500

^a Bureau of Labor Statistics from New York Journal of Commerce from 1913-1915 and Record and Guide 1916-1918.
^b No quotation; plant sold.

dustry and by the allocation of Government orders among the mills.

After the armistice was signed and war orders were reduced, the cement mills began producing to replenish their depleted stocks, and by the end of the year they had their normal stock of 10,000,000 barrels.

The exports of cement have never been large in proportion to the total volume of production, the maximum of 4,215,532 barrels in 1912 being due in part to exports for the Panama Canal; the average annual exports have been about 2,500,000 barrels. While the total exports of cement during 1918 were almost normal on account of large shipments of cement for fortifications for the Panama Canal, the exports to South American countries and to Canada were considerably less than normal on account of the scarcity of ships. Imports are of trifling importance, as European Portland cement can not profitably compete with our industry. The quantity imported was 120,906 barrels in 1914, but it declined to only 1,836 barrels in 1916. Cement was placed on the restricted import list of the War Trade Board. This restriction had little effect, however, since heavy freight rates and the lack of demand for foreign cement had already reduced the imports to a negligible quantity.

The production of cement and trade in cement is shown by the following table:*

Portland Cement (Barrels)				Domes- tic con- sumption†
	Production	Exports	Imports	
1913.....	92,097,131	2,964,358	85,470	85,810,489
1914.....	88,230,170	2,140,197	120,906	84,418,665
1915.....	85,914,907	2,565,031	42,218	84,368,868
1916.....	91,521,198	2,563,976	1,836	91,990,156
1917.....	92,814,202	2,586,215	2,326	88,119,584
1918.....	71,632,000	2,252,446	7,922	69,400,476

*Statistics from U. S. Geological Survey.

†These figures allow for difference in stocks.

Explanation of Weights

The weights used in computing the index number of cement are the 1917 production plus imports of each commodity, as follows:

	Barrels.
Portland cement	92,800,000
Natural cement	565,000

The monthly aggregates for cement were obtained by multiplying the average prices of Portland cement of six different plants in Northeastern United States by the total production of Portland cement in 1917. While the price of Portland cement varies in different localities and the price on the Pacific coast is higher than the prices of the plants quoted, it is believed that the average used in this table is fairly representative of the industry as a whole. The price of natural cement in Kansas was multiplied by the total production of natural cement in 1917.

Westinghouse War Memorial Scholarships Awarded

The awards of the four annual War Memorial Scholarships of five hundred dollars each, established by the Westinghouse Electric & Manufacturing Company, have just been announced. These awards were made by competitive examinations and the following men were successful:

Herbert S. Pahren, Cincinnati, Ohio, employed as order clerk in the Cincinnati Office of the Westinghouse Company, and a graduate of the Hughes High School, who has selected for his scholarship a Technical Engineering Course at the University of Wisconsin.

Arthur Marthens of East Pittsburgh, Pa., began work as a messenger boy before completing his studies in the Turtle Creek Schools. Mr. Marthens, while

working in the Cost Department prepared himself in the Casino Technical Night School to enter college. He has chosen a course in Electrical Engineering at the Carnegie Institute of Technology.

Paul O. Langguth, a graduate of the Wilkinsburg High School and employed as draftsman in the Engineering Department at East Pittsburgh, has selected as his award an Electrical Engineering Course at the University of Pittsburgh.

Andrew P. Lesniak, a graduate of the Union High School, Turtle Creek, Pa., and employed in the Production Department at East Pittsburgh, has selected a course in Mechanical Engineering at the University of Pittsburgh.

Two classes of scholarships are provided:

(a) For sons of employees of the company or its subsidiaries who have been employed for five years or longer.

(b) For employees of the Company and its subsidiaries who have been continuously employed for at least two years and who shall not, on September 1, have exceeded the age of 23. Not more than two class B scholarships will be awarded in any year.

Each scholarship carries with an annual payment of five hundred dollars for a period not to exceed four years, the payment to be applied toward an engineering education in any technical school or college selected by the successful candidate with the approval of the scholarship committee.

These scholarships have been established as a memorial to those employees of the Company and its subsidiaries who entered the service of their country during the war. Four awards will be made each year, so that after three years this Company will be maintaining sixteen of these scholarships in the best technical schools of the United States.

Cement Freight Rates in Oregon

One of Oregon's industries, the Oregon Portland Cement Company of Oswego, is involved in a fight for its existence, according to A. G. Clark, manager of the Associated Industries of Oregon, in a statement issued today. It is in connection with the special rate hearing to come before the interstate commerce commission Saturday morning, in which the local concern will have arrayed against it practically all the big firms of the country, says the Portland, Oregon, Telegram.

"Rate experts employed by Eastern and California cement firms and the San Francisco Chamber of Commerce will be at the hearing," said Clark, "and they will all consolidate in an effort to throttle the Oregon industry.

"The Oregon plant was constructed after the present rates were established and the cement interests in adjoining states do not want conditions disturbed. If proper rate adjustments for handling cement are made, it will mean lower prices for cement to the consumer. Cement interests outside of Oregon want the present rates out of Portland maintained, because they limit the territory of the local industry and permit outside concerns to use Oregon for a dumping ground for their surplus.

"The high rate for the local industry and the low rate for its competitors makes Oregon a big loser and is costing the consumer thousands of dollars and keeps the cement industry in this state from growing. Cement concerns from all points West of the Rocky Mountains are arrayed against Oregon industry in this respect, and even the railroads themselves, show but little enthusiasm, making the outcome of the case very uncertain."



Direct Charging System in Concrete Road Construction, H. W. Nelson's Train of Steel Batch Boxes at the Mixer

Concrete Road Work in Illinois

The extent to which railroad and steamshovel contractors, generally, are equipping themselves for entering the road-building field on a large scale, is one of the signs of a new era in road construction.

Everyone, in the Middle West at least, knows J. O. Heyworth of Chicago, whose work on the Sag Canal and in the construction of huge docks at Indiana Harbor, on Lake Michigan, has been noted in the various trade papers. H. W. Nelson, another Chicago contractor, also is widely known. His railroad work for the Illinois Central, near Vicksburg, Miss., has been described in various magazines. As both of these contractors, in the absence of railroad work, have entered the road-building field, their method of handling contracts will be of interest and, perhaps, value to others similarly situated.

Among various contracts, Mr. Heyworth is building a road from St. Charles to DeKalb, Illinois, a distance of twenty and one-half miles, the work being in charge of Superintendent Anderson. This is a high-class concrete road, much of it forming the Lincoln Highway. The concrete is laid eighteen feet wide, seven inches thick at the sides and eight inches at the center.

It will be noted from this contractor's equipment and methods that he is cutting out labor, as far as possible. His material is unloaded by clamshell into substantially-built, portable bins, from which it is taken by gravity for delivery by industrial railway to the Boss mixer. These bins form a single structure, so put together that the sections can be loaded upon flat cars and readily moved. The bins, each thirty-four feet long, will hold three carloads of cement, sand and crushed stone, respectively.

The "direct-charging" method of concrete construction is being employed to cut down the labor item still further, Western Road Builders' Trucks and Western oak batch boxes being used. Each truck carries two boxes and they are handled on a 24-inch gauge railroad, in two trains of twenty cars each, hauled by gasoline locomotives.

A train of empty batch cars is backed under the material bins, where each box is loaded by gravity in an incredibly short time, with sand, cement and gravel in the desired mixture to form a batch of aggregate. Mr. Heyworth is using the 1-2-3½ mixture. This aggregate is delivered by train to the mixer at the rate of 40 batches an hour, where it is emptied into the skip through a bottom door, the batch boxes being lifted, one at a time, and swung in position over the skip by crane.

In this way, with a minimum of labor, 400 batches are put through the mixer in the course of a 10-hour day, making 500 lineal feet of paving. A Lakewood



Road Builders Service Cars Loaded with Portable Track



Lakewood Finishing Machine Saving the Labor of Men

Finisher, and a machine for shaping the subgrade are other labor-saving devices employed. Whenever it becomes necessary in grading to move loosened earth, a team with a Western slip scraper quickly accomplishes the work. An Austin road roller completes the equipment.

Superintendent Anderson established his first camp

and material yard one and one-half miles east of Cortland and began paving at DeKalb, distant about four and one-half miles. He expects to complete the work in three "set-ups" of bins and track.

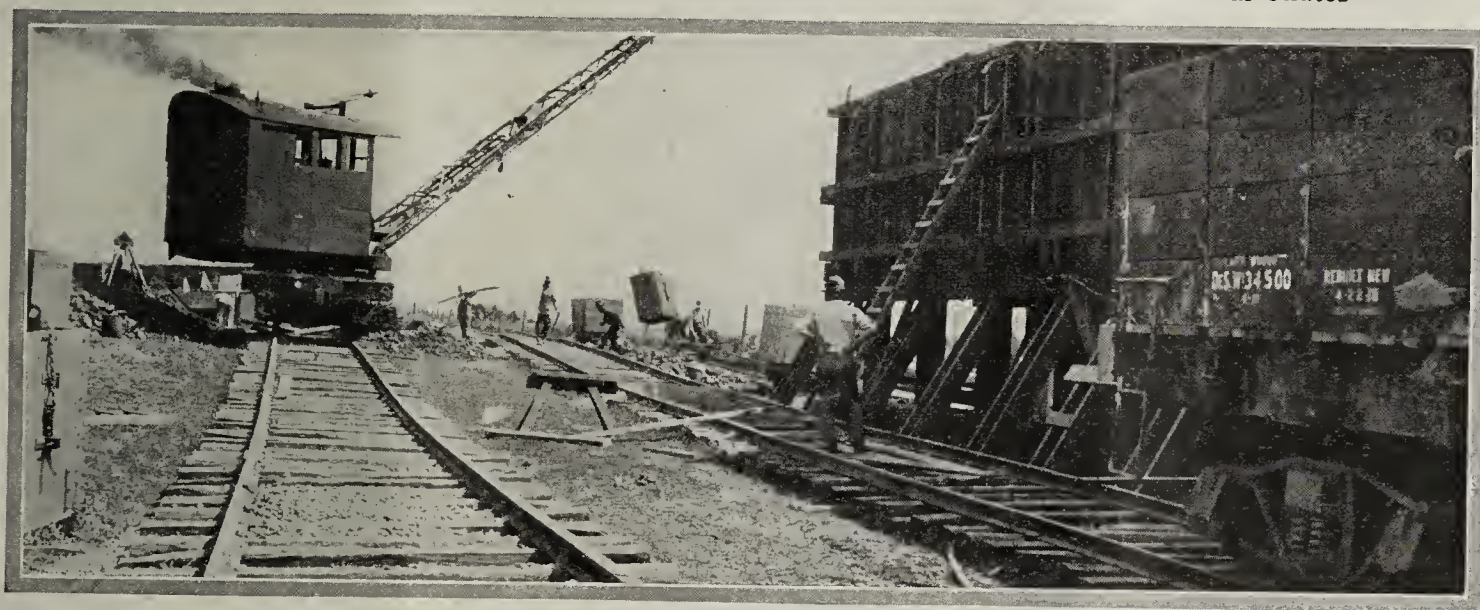
The Miller, Stuart Nelson Company, with H. W. Nelson as manager, are laying ten miles of concrete, near Chicago, on what is known as the Desplaines



H. W. Nelson's Material Bins, Near Desplaines, Ill.



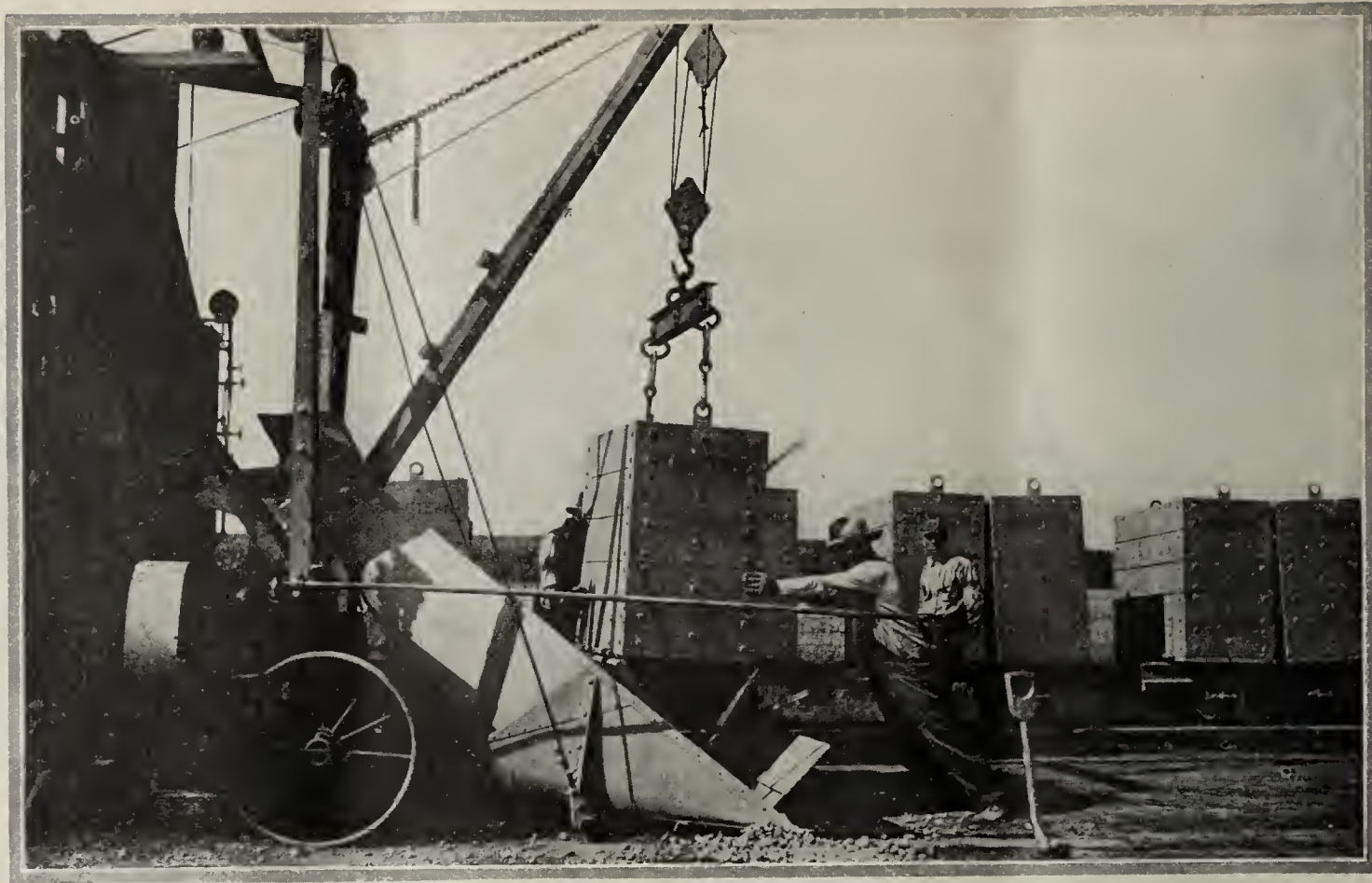
Loading Batch Boxes at J. O. Heyworth's Bins. Each Bin Has Several Chutes



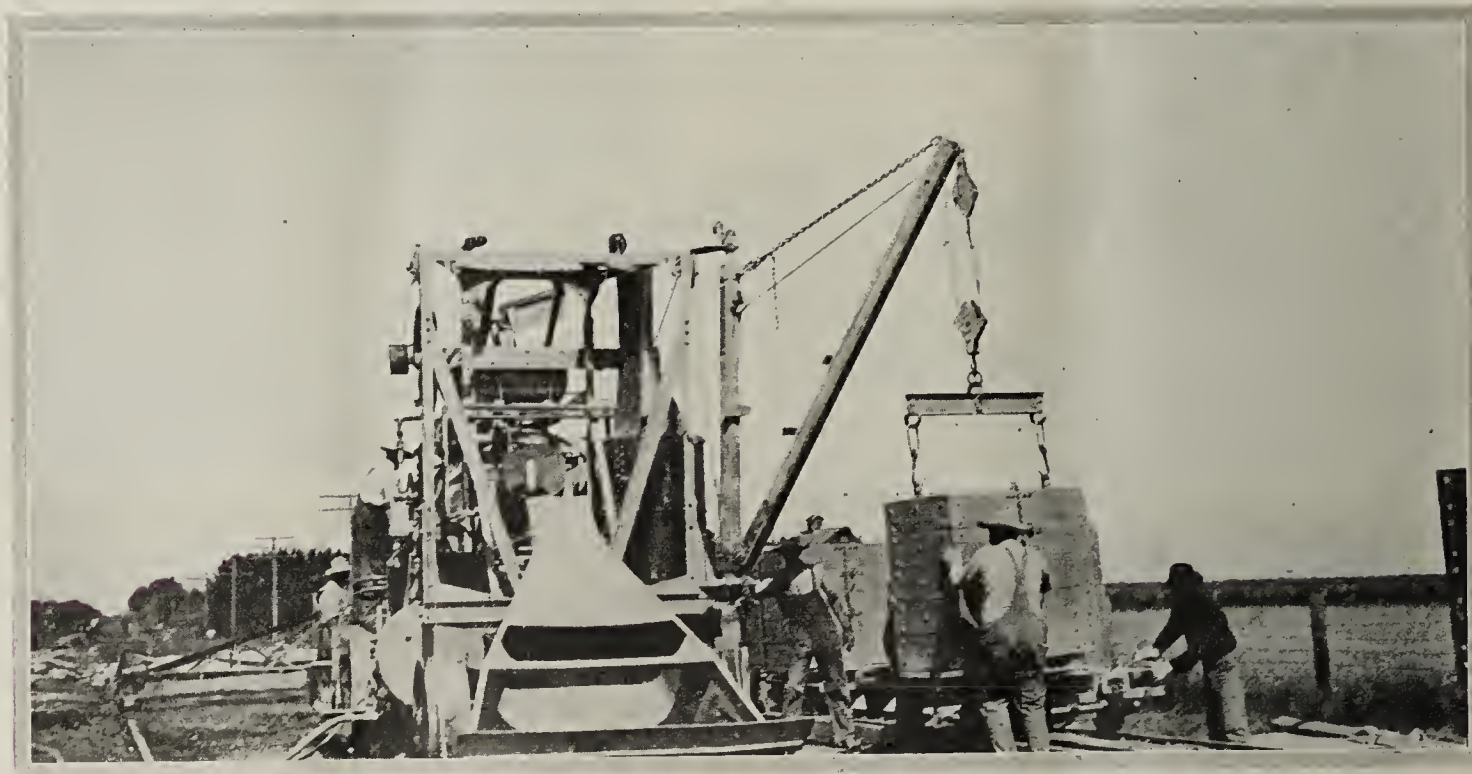
Assembling a Train of Batch Boxes—J. O. Heyworth's Work



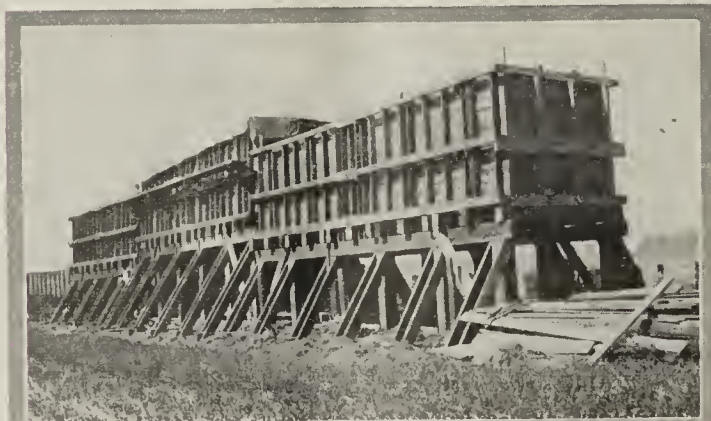
Train of J. O. Heyworth's Batch Boxes at the Mixer



Unloading a Batch Box Into the Mixer Skip.—J. O. Heyworth's Contract



J. O. Heyworth's Work—Lifting a Batch Box from the Truck.



J. O. Heyworth's Portable Material Bin in Three Sections



Water on the Finished Pavement at Desplaines to Prevent Too Rapid Hardening

River Road, handling the job in the same way and with similar equipment except that Western steel batch boxes are used instead of those of wood construction, and the material bins form two structures instead of one. North of the town of Desplaines the pavement will extend four and one-half miles and south, five and one-half miles.

The equipment includes two 8-ton and two 3-ton gasoline locomotives; 40 Western Road Builders' Trucks; 80 Western steel batch boxes; five miles of 24-inch gauge portable track; a Boss Mixer; subgrading machine; Austin Roller, material bins, crane, etc. At the time the photographs were taken the haul was about 1,200 feet and two trains were being operated.

J. S. Black, the efficient superintendent in charge of the work, stated that his intention was to operate four trains. From 600 to 700 lineal feet of paving were being put in each day.

The material yard is most advantageously placed, on a siding, along the Chicago & North Western Railroad, a mile and a half from Desplaines. According to Superintendent Black, the use of the direct-charging system, together with the finishing machine, enables him to do the work with a dozen men, all told, where otherwise some 25 or more would have to be employed. As Mr. Nelson is paying the highest union wages, from 70 cents to \$1.00 an hour, according to the work, the saving is very great.

Garages with a Waterproofed White Stucco Finish

Details of Composition and Application of Stainless Cement Exterior

Through the courtesy of Geo. W. Netcher, architect, of Tiffin, Ohio, we are illustrating a garage of unusually interesting design and construction, the exterior of which is white cement. Many costly residences, particularly in the city of Tiffin, have been planned by Mr. Netcher, and cement stucco is used on the exterior, applied to metal lath and hollow tile.

Our readers will find the statement of C. L. Ball, Coldwater, Michigan, stucco contractor, very informative and valuable.

"I have been doing stucco work for the past fifteen or twenty years, and am pleased to give you my method of putting on this work.

"I make a plastering mortar of clean sand, lime and rope fibre—mortar to be lean, not rich. Taking four pails of mortar and one pail of cement, I mix thoroughly and apply, and give the surface a rough-swept finish. When dry, dampen and apply second coat of $2\frac{1}{2}$ parts sand to 1 part of cement and 10% lime—surface to be left under float. Before rough-casting, whitewash with cement and 10% lime.

"The rough cast is made of 1 part fine sand, 1 part cement and 10% lime. Apply with whisk broom. Usually four to six coats are given the wall; the more coats the rougher the surface will be, and the better the job. I add Medusa waterproofing the last two times over. It is best not to put in too much waterproofing in mixtures until nearly through rough-casting.

"I am not in favor of 'patent' stucco, and think 'cement stucco' best if done right, applied to metal lath, using clean sand and proper workmanship. Medusa Waterproofing and Medusa White Portland Cement have been used in most of my stucco work and make a perfect and stainless finish."

Concrete Building Methods

Graux, Tryemur, E. C. P., 13 Rue de Naples, Paris, France, writes us as follows: "I should be greatly interested by information about any machinery, and generally about different systems used in the United States for erecting workmen's lodgings. Concrete block machinery is a solution of this problem, but there is another, which, I think, would be more economical, by pouring a very liquid concrete inside proper iron or wooden chests (forms). Rather than

carry the mixer from one point to another, with great loss of time, it should be better to have a large mixer and to use aerial conveyors to carry the concrete where it is required, then it could be put inside the chests by means of proper hose. I want information about this system, as well as about concrete machinery, thus: Concrete block machines, concrete mixers, wooden and iron chests, concrete aerial conveyors and hose for concrete."

Jiffy Column Clamps

Paul W. Koch & Company, Lees Bldg., Chicago, manufacturers the "Jiffy" clamp suitable for clamping columns and other rectangular forms in which concrete is cast. The clamp consists of two pair of pivoted arms, with malleable brackets attached so that they cannot be loosened. After a column has been poured, half the clamps may be removed from it within a few hours and set up for the next floor. By the time everything is ready for the next set-up the balance of the forms can be removed and in this way 50% of the forms are required. The wedge is made so that a 50d cut nail may be used for the purpose of holding it in place. These clamps are sent out on approval with the privilege of applying the rental on the purchase price.



Cement Stucco Garage. C. L. Ball, Stucco Contractor, Coldwater, Mich.

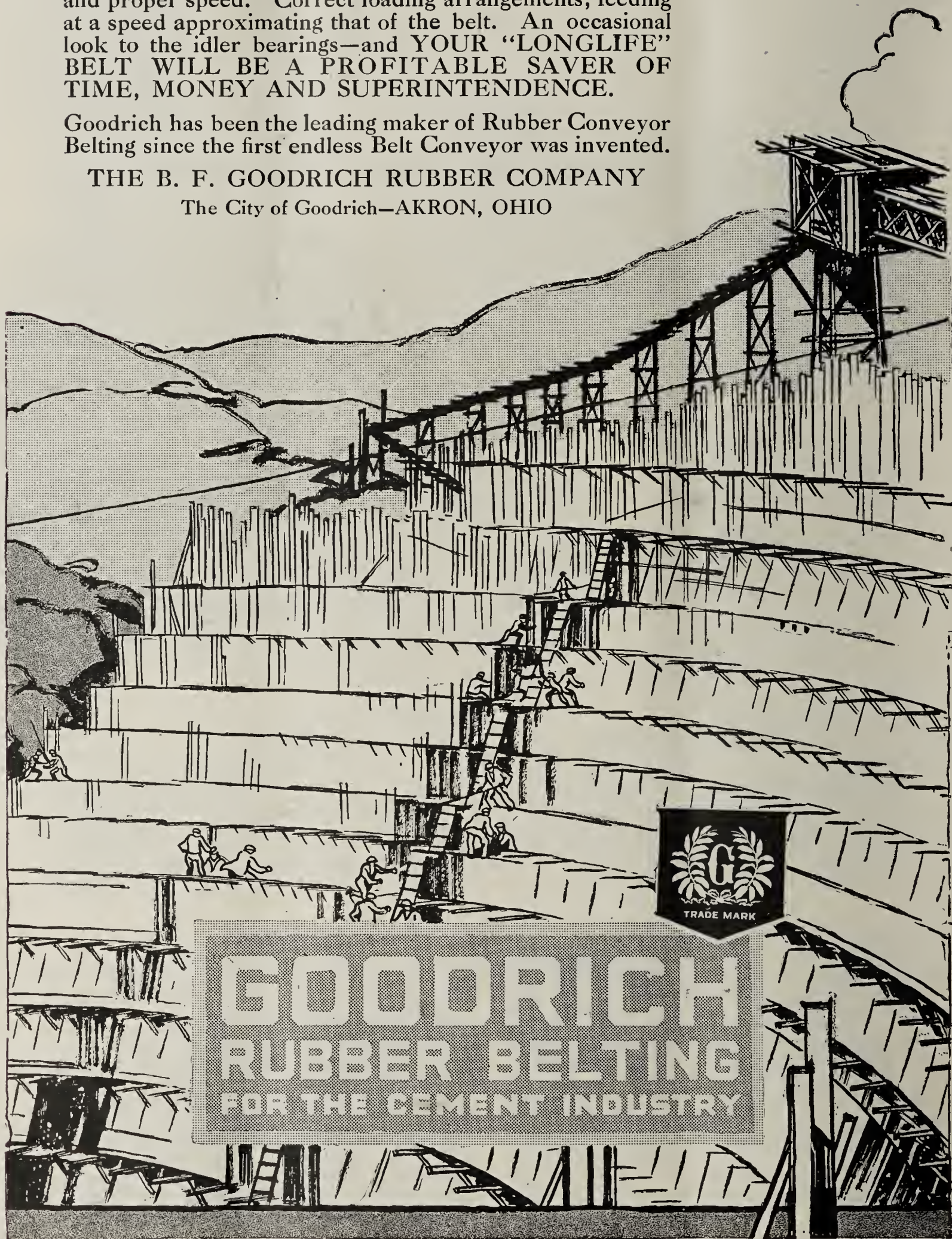
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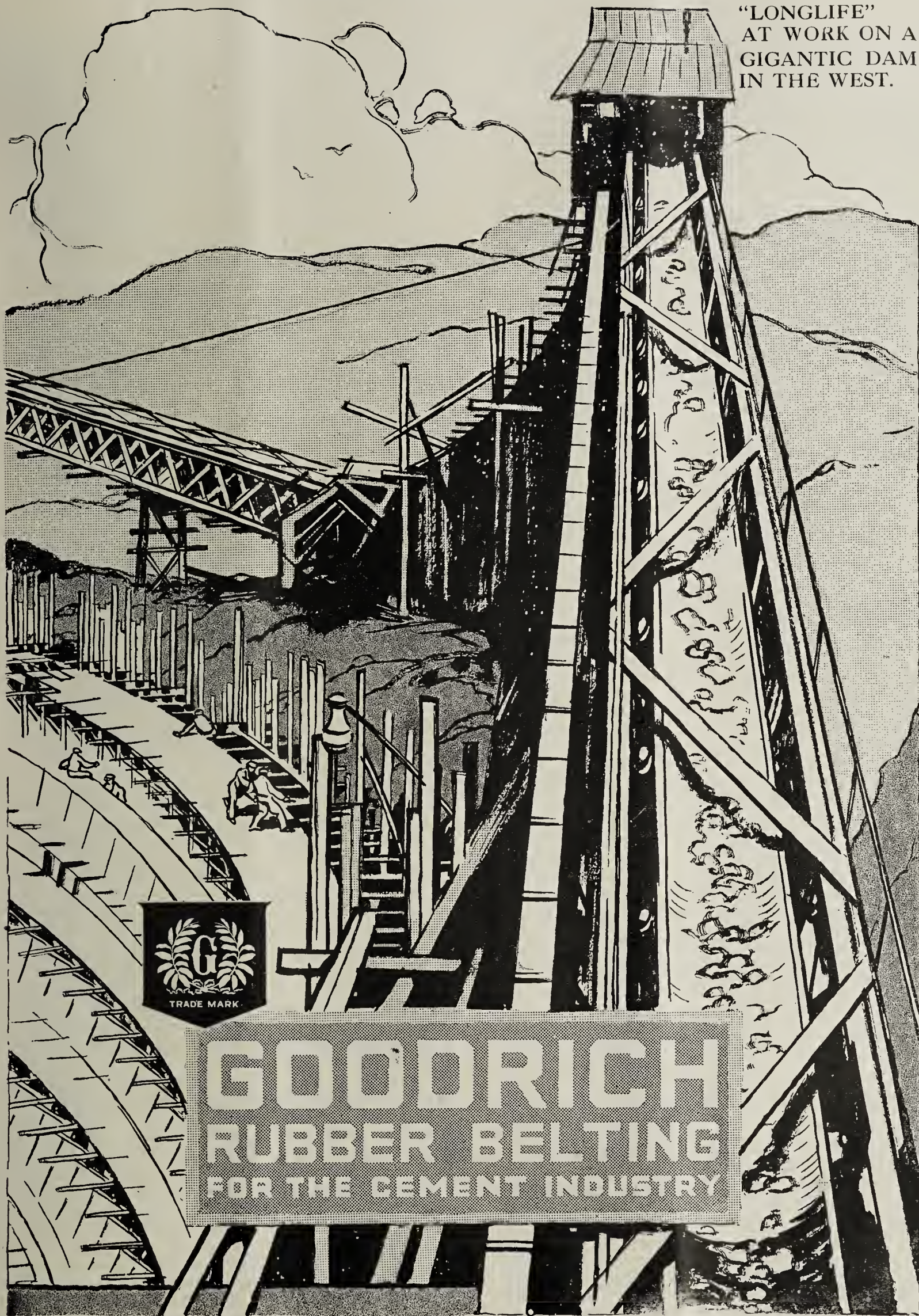
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GIGANTIC DAM
IN THE WEST.



GOODRICH
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FOR THE CEMENT INDUSTRY

Address by Charles Piez, President Link-Belt Company, Chicago, to the Roadmaster's Union, Chicago, September 17, 1919

Mr. Chairman and Gentlemen: It is a peculiar coincidence that the three speakers selected for this evening, Colonel Arms, Mr. Preston and myself, should represent the railroads, the water, and the air service during the war. I am very glad, indeed, to learn from Mr. Preston's very interesting remarks that there was justification for a departure from the aeroplane engine that had been developed by our Allies, because we can all recognize the truth of his statement that a man in a slow aeroplane is absolutely at the mercy of the man in a speedier machine. I questioned very much, myself, the wisdom of such a change as that made when we decided to adopt the Liberty Motor, but in the light of Mr. Preston's statements, I gladly accept the decision as a wise and proper one. We certainly did not want any American boy to be at a disadvantage in his conflict with the foe.

I am firmly convinced that the accomplishments of the various departments of the Government during the time of war will receive increasing recognition, and that much of the criticism that was directed against them will disappear. After all, our chief fault lay in the over-optimistic promises of accomplishment that various department heads made. That was certainly the case in the Air Service, and even the Emergency Fleet Corporation, with which I was connected for a period of nineteen months, suffered from the fact that the prediction was made in September, 1917, that we would produce 6,000,000 deadweight tons of shipping in the year 1918.

At the time that statement was made there were between forty and fifty thousand men in the shipyards of the country, a considerable part of whom were engaged in navy work, and we were producing at the rate of not to exceed 600,000 tons of shipping per year. The promise, therefore, of an output of 6,000,000 tons in the absence of an experienced corps of workmen, and in the absence of necessary facilities, betrayed great confidence in our capacity to work miracles, but did not indicate that we understood at that time all the difficulties that lay in the way of reaching that goal. To accomplish that, we had to increase the number of workmen in the yards from 50,000 to 350,000. We had to build new yards and new shops, and yet, in spite of that, the Emergency Fleet Corporation delivered about 3,100,000 tons of shipping in 1918, and had on the stocks and in the yards, over 5,000,000 deadweight tons, which, in the state of their completion at the end of 1918, represented the equivalent of about 2,000,000 tons of completed shipping, so that the real accomplishment of the Fleet Corporation for 1918 was substantially 5,100,000 tons, not such an awful drop from the optimistic predictions of the Shipping Board head.

Criticism has been directed against the Air Service, the Shipping Board, and other departments of the Government, did not arise out of lack of accomplishment, but it grew rather out of the fact that accomplishment fell behind expectations.

But I did not intend this evening to talk to you on matters connected with the Shipping Board and the Emergency Fleet Corporation, but rather to address you on the subject of labor unrest, a subject that you gentlemen, in your control of four or five hundred thousand workmen, must of course be much interested in. Let me say, in the first place, that I had the privilege, some weeks ago, of appearing before the House Committee on Interstate and Foreign Commerce, and to register there the overwhelming conviction of the members of the Illinois Manufacturers' Association that the railroads of the country should be returned

as soon as possible to private ownership and private operation, and to record an overwhelming sentiment against the adoption of the Plumb Bill. You gentlemen, of course, are familiar with that measure, because it so vitally and directly affects your own positions, and I need say nothing more than to assert that there is very little, or no, chance for the people of the United States to acquire a property worth twenty billions of dollars out of public funds, and to lease that property, without restrictions, reservations, or power of revocation, to the employees of the railroads to run as they see fit, the public retaining only the very doubtful privilege of paying the deficit which will inevitably result from such an experiment.

I wish at this time to emphasize one point in the recommendations submitted to the Committee of Congress by the Illinois Manufacturers' Association, namely, that the Interstate Commerce Commission should take control of the determination of wages; that it should be authorized to appoint an Arbitration Board which should have the power to adjudicate differences between the employees and the railway management; redress wrongs; and, by authority of the Commission, determine the rates of pay. Our suggestion incorporated also the provision that appeal from this Board's findings should lie with the Interstate Commerce Commission. As a part of the machinery thus created, and in recognition of the paramount rights and interests of the public in the continuous and efficient operation of the transportation lines, I suggested that the employees of the railroads, as a part of their contract of hiring, should accept the provisions of the act, subjecting themselves to the findings and decisions of the Arbitration Board and the Interstate Commerce Commission, and waive their right to strike. The right of an individual to resign from his employment could, of course, not be denied, but the right of all railroad employees to strike collectively to enforce claims which an impartial and public body has denied, is a constant peril to the public interest, and should, for the public good, be waived.

I believe most firmly that future operations of the railroads cannot, if the men persist in such an action as that of the employees of the Southwestern railroads, be efficiently conducted and maintained, unless the men accept legal and financial responsibility for any acts of their officers or officials which put the public to discomfort, loss or privation. The general public has a right to demand, after proper machinery is provided to consider impartially any claims for higher wages or modified conditions, that the men accept this machinery and abide by its decisions. Men who are unwilling to subject themselves to the discipline which a public body imposes on them in the public interest, should seek employment elsewhere, and should not be a constant menace to the well-being—yes, the very life of the public.

Some question was raised by members of the Committee on Interstate and Foreign Commerce as to the desirability of making the Interstate Commerce Committee accept responsibility, not only for the determination of wages, but for the adjudication of differences and the redress of wrongs. To my mind, the body that determines rates should also determine the pay of the men, for the rates, after all, must be based on the amount of wages paid. In the case of the Fleet Corporation, an outside body had the right to determine the scale of wages, and I am satisfied, from my experience there, that this was a mistake; because that body, while it exercised the best judgment of which it was capable, was under no such responsibility in

securing an economic execution of a program as were the officers of the Corporation, who had to appear before Congress, secure appropriations for construction, and, later on, justify further demand for appropriations to cover deficiencies. I believe the two responsibilities belong together; that the man or authority that fixes wages must have the right to fix prices, and the reverse. The Interstate Commerce Commission is a public body, appointed by the President and approved by the Senate. Its members ought to reflect public sentiment, and the position is one of such responsibility, their knowledge of the needs of the shippers and the public so complete, that they are in better position to determine a proper scale of wages than any outside or independent body appointed for that purpose would be.

Perhaps nowhere is there so much cause for distrust and lack of confidence in the future as in the relations between employers and employees. The spirit of unrest which arose quite naturally as a result of the war, is being fanned to a flame by unscrupulous agitators, who are seeking to further their own selfish interests in the general disorganization of industry and of public utilities, which their action is intended to bring about.

While the strikes that are everywhere prevalent are instituted for the nominal purpose of increasing wages and adjusting conditions, there is apparent a very much more sinister purpose behind many of these outbreaks; the purpose to overthrow our social and industrial system; to destroy the right of the individual to possess and enjoy property; and to place the industries themselves in the hands of a leadership that has no knowledge of economic laws and no respect for the laws of the United States. Covenants solemnly entered into on behalf of the workers by their officers and the employers, are broken whenever it appears to the interest of the workers to break them.

The shipyard strike in Seattle is a conspicuous example of the breach of a contract entered into with the Government itself. This agreement was signed on behalf of the men by the International Presidents of the various crafts in the shipyards; it was amended at the special requests of representatives of the Puget Sound District, and the amended agreement was again signed by the international officers. A request for an advance of wages from 70 cents to one dollar an hour, was made to the Board created by the agreement, and this Board decided, after a review of all the circumstances and an examination of the increased cost of living since the last grant of an increase, that 80 cents per hour should be proper compensation. The men appealed from the Board to an Appeal Board created under the same agreement. The Appeal Board declined to sustain the appeal. The men, dissatisfied with the decision, and unmindful of the fact that under their agreement with the Government they were compelled to continue at work until the expiration of the six-months' period, went on a strike about January 26th, although under the agreement they would have had to continue work only until March 31st to have lived up to its letter and spirit. The Fleet Corporation declined at that time to have any conferences with the men until they returned to work. A general strike was called in Seattle to force the Government into a compromise, but this failed.

Yet I am certain, from private information furnished us by our secret service agents, that the Seattle strike was not sustained by the will of the majority of the shipyard workers in that district. As a matter of fact, the Boilermakers' Union, with 15,000 members in the shipyards, reached its decision in a hall

which accommodated but 900 persons, so that a majority of 900 men decided the fate of 15,000 in so important a matter as the breach of a contract entered into between the men and the Government of the United States.

Everywhere breaches of contract are indulged in because short-sighted and unwise leaders feel that an advantage can be gained by an immediate breach, and yet I submit that the respect and confidence of the public, which conservative action on the part of union leaders has earned in the past, is absolutely sacrificed to the wanton and irresponsible exercise of powers by leaders who are unfit, in intelligence and temperament, to represent the interests of the members of the organizations of which they are officers.

Collective bargaining must be the result of conference and must result in an agreement setting forth the conditions and the covenants. The success of collective bargaining depends wholly on the spirit with which the agreement resulting from collective bargaining is carried out. If the men are unwise enough to break a contract, they can hardly insist that the employer or the Government shall enter into another, superseding the one just broken. There must be a broad conception of the responsibility which an agreement carries with it, on the part of each and every member of an organization, if employers are expected to continue collective bargaining as the basis of wage agreements. Welching on a contract destroys confidence, and without mutual confidence, there can be no satisfactory solution of the wage question.

I am glad to see that some of the officers of organized labor are advocating disciplining the unions that break their contracts, and it is only when this action becomes general, and when the unions must accept responsibility for the acts of their officers, that stability in labor conditions can be looked forward to.

I sometimes feel that breaches in agreements are committed solely for the purpose of putting industry and transportation into such a chaotic state that the opportunity for that Russian importation, the dictatorship of the proletariat, may be afforded. We have imported many phrases from foreign sources these last few years, that have a ringing and threatening sound in the mouths of malcontents, and they all involve a menace to the basic principles of our government.

We are celebrating today the 132nd anniversary of the adoption of the Constitution, and it is well for us to pay some heed to the principles on which this Republic was founded, and to which it owes its unparalleled success. We govern ourselves through representatives chosen by a majority, and we shall insist upon so governing ourselves in spite of threats, coercion or violence on the part of an aggressive and unwisely led minority. If we are to submit to any changes in our organic law, we will do so readily and cheerfully after those changes have been duly considered by our people, and after they have been made a part of our constitution, in the manner prescribed for amendments and additions to that document.

If we are going to sacrifice the right to own and enjoy private property, and if we are going into a communal or socialistic form of government, we want the majority to decide it after due consideration, and we will gladly submit, for after one hundred and thirty-two years of the successful administration of government under the Constitution, we are not going to be misled by the clamors of noisy and violent groups, but we are going to stick close to our constitutional form of government, and we are going to take proper steps to insure that that form of government be adhered to.

Road Maintenance in Champaign County, Ohio

By Henry B. Hull, County Engineer

County road maintenance has been and is one of the hardest problems county officials have to contend with, especially road officials, viz: County surveyors, county commissioners and township trustees. There are 88 counties in the state of Ohio, and in each county there is a Board of County Commissioners, County Surveyor and Township Trustees, yet scarcely two counties in all of the 88 have the same system of maintenance for their county roads. The state of Ohio has a State Highway Commission, one of whose duties it is to make a standard for all roads constructed by the state in the various counties over the state, but the counties themselves have no such system, and are woefully lacking in this respect.

Having been connected for several years with the county surveyor's office of Champaign County, I have observed during that time that the very best way of securing good results in the maintenance of our county roads is to have a head for an organization with which to operate on this maintenance work.

In the last few years it has been almost impossible at different times during the year to rely on the farmers and their teams and wagons to put enough material of the right sort out to enable the roads to withstand the enormous amount of heavy traffic which they carry. Consequently, up until two years ago with the automobile and the increased amount of truck traffic our roads began to rapidly disintegrate. In fact, what once were good gravel roads were soon torn up and deeply rutted by this comparatively new traffic.

It occurred to me that to get good material on the road at the right time was not to wait until the corn was plowed or the crops harvested, but to get motor trucks and hire good, capable men to drive them, men who would devote their entire time to hauling material on our roads. With this idea in mind I went before our Board of County Commissioners and informed them that if we were to keep up our roads it would be necessary for the county to purchase equipment to do so.

Before I go any further, let me state right here that it is necessary for all county road officials to co-operate and have harmony among themselves in order that the best results may be obtained. Our Board of County Commissioners, comprised of Mr. Morris Leffel, Mr. A. M. Glendenning and Mr. Grant Hunt, are good, broad-minded, progressive men who are not afraid to expend the county's money for any kind of equipment with which the public will be greatly benefited, and they had the utmost confidence in my plan.

They bought two five-ton motor trucks with dump bodies. They also bought three unloaders, and at the same time gave me permission to construct unloading pits for screened gravel and crushed boulders at different railroad points in our county. The money for this equipment was taken from the county fund and it is the property of the entire county.

At close cost data is kept on all of our equipment and it is the greatest money-maker of the county.



An Example of the Excellent Result of Scientific Road Maintenance in Champaign County, Ohio

Not only can we give the townships service never dreamed of before, but we put on material when it is wanted, and are then gone until the following year, leaving everybody feeling fine and in the best of spirits.



One of the Five-Ton Motor Truck Depositing Material on the Road

The pits are permanent and are so located over the various parts of the county that no haul will be greater than four and a half miles. The unloaders are portable and can be moved from place to place. With this equipment we started out to put crushed boulders on our county roads, which is done in this manner:

Once every year we send notices to each Board of Township Trustees and ask the amount of money they will have to purchase material for the following year. These reports are kept on file in our office, and in this way we know just what each township will need in the way of road material for that year, doing away with the old method of having, for instance, \$5,000 to spend; \$2,500 would be spent for material, while the other \$2,500 would be spent in getting it hauled out.

In this manner the townships which have this amount to spend get the full benefit of their money, as their hauling is done by the county, and consequently they receive just double the amount they formerly did. They also get the material on in a speedy and workmanlike manner and not from some dirty, stony, gravel pit where material is never screened, and coarse and fine alike are put on, and where the clay or loam is never separated but put on with the gravel.

With the old method, difference in the size of loads hauled varied. One man would be hauling a yard, another three-quarters of a yard, and probably another a half yard. With these kind of loads dumped along a road and allowed to pack under the traffic it became like an "ocean wave."

All the trustees have to do is to get us this report each year and we advise the next township where we are to go, of our coming, that they may have the roads that are to receive the material scraped up and in good shape to receive the same.

Both the surveyor's office and the county Commissioners were criticised when this equipment was purchased, but as time goes on and the taxpayers see for themselves the enormous amount of road material that is put out each year, and at such a reasonable cost they have come to the conclusion that it is far the best and cheapest plan, and my greatest trouble now, with our limited equipment, is how to get to each township every year, as the demand is great and everybody wants it first. With our limited equipment all we can do is to have them wait until we can get there.

On an average haul of three miles we can put on probably a mile of screened gravel or crushed boulders a week, according to the weather conditions. The material which we find the best for this purpose is crushed boulders, and runs in size from one inch down to dust, which is purchased from a large and well-known washing, screening and crushing sand and gravel plant in the eastern part of our county, which has given us the best service possible, especially the past year when freight transportation was so uncertain.

The crushed boulders are placed on in different depths from 6 to 10 inches deep and is spread out from 8 to 10 feet wide. This material packs quickly and makes a good, firm, solid road which does not cut through in early spring time when the thaw comes, like ordinary unwashed gravel. With a small road drag they are easily maintained and the people of our county are greatly pleased whenever they strike one of these roads, especially with an automobile. One of the best arguments we can use on this type of road is that we have pleased the public, and all road officials know that is something.

The cost of material for a road of this kind is from \$1,200 to \$1,500 per mile, and with a little care, such

as dragging and patching, will wear for several years.

The reader of this article must bear in mind that all of our roads are not of this construction, as we have



One of the Galion Unloaders

only been at it for two years, and as there are over 800 miles of roads in our county, it will be some time before we can get crushed boulders on a large majority of them. But we think we have started in the right direction, and it has ceased to be an experiment.

State Cement Plant for South Dakota

State officials have recently been on a tour of inspection of Iowa cement manufacturing plants for the purpose of gathering information as to the manufacture of this commodity by the state of South Dakota, says the Huron, S. D., News.

The Iowa plants make their product out of limestone, it is understood, whereas the most feasible material for a South Dakota plant would most certainly be chalkstone. This is found in great quantities along the Missouri river, and it was because of these huge deposits above Yankton on this river that the great plant located there now idle for a number of years, was built.

The Yankton location was considered by experts to be as good as any to be found anywhere—the existence of deposits of the right material there leading many experienced cement men, in fact, to declare it the best in the world. The plant there was closed down, not because it could not be made to pay and not because it did not have material and equipment adequate. It was bought up by the combination and closed down, the investment which might have brought good returns if operated probably bringing in even greater revenue lying idle and thus cutting out undesirable competition.

Moulding Houses in Steel Forms for War Workers

By Milton Dana Morrill, Architect, 223 E. 17th Street, New York City

The old saying that "Necessity is the Mother of Invention" has proved true in many of our war-time activities. We needed ships! We needed guns! We needed munitions, and to get these we had to have dwellings to house the workmen. Overlook Colony, situated seven miles north of Wilmington, Delaware, was in the midst of the field of war-work congestion. Houses were urgently needed for the workmen making munition chemicals. There was a scarcity of ordinary building materials, and transportation was a difficult matter even if these could be purchased.

Investigation showed that there was an ample supply close at hand of crushed coal cinders, ordinarily considered a waste product, for making cinder concrete. Samples were taken and test blocks made and the cinders were analyzed for sulphur, as a high percentage of sulphur affects the strength of the concrete. These test blocks showed a crushing strength of 1,800 lbs. per square inch, whereas in the ordinary house walls the load seldom exceeds 120 lbs. per square inch. This showed that cinder concrete, while it could not be expected to compare with stone concrete in strength, was still amply strong for light construction, such as

steel plates could be taken off. These plates were then moved forward and again set up, making moulds to continue the foundation walls. As soon as the first course or belt of concrete was completed around the building, the plates were again set up on top of the first course and a second course of concrete started. This process was continued up, course after course, till the walls reached the height of the roof plate. When this point was reached the moulds were taken apart and ready to be moved to the next job. The speed with which the work was done depended upon the size of the steel mould equipment. The work at Overlook Colony was done with No. 3 wall-moulding outfits.

These steel moulds were simple to operate. The United States Government has utilized unskilled labor to put up many large buildings, using these steel moulds for the work.

Ten of these No. 3 wall-moulding outfits were used on the Overlook Colony houses. Each of the outfits were made up of twelve moulds. The cost of a complete house-building outfit of this kind is \$200, but as these steel plates can be used over and over on job after job the cost per house is a small item.



The Three Gables Form a Central Feature in the 39 House Group

house walls, and with the steel reinforcing rods imbedded in the concrete as the work was being done, these cinder concrete walls were far stronger and more substantial than the usual walls of brick or of tile construction.

Seventy-five houses were built of this cinder concrete construction at Overlook Colony. Speed of construction was considered especially necessary in this housing work. Part of the work was done in the usual wooden forms, but the lumber loss and the labor wasted in making the wood forms proved this to be an expensive construction. A method of moulding walls by the use of steel forms was employed on this particular group of houses. It is here illustrated and described how these steel forms were used over and over again for house after house. The work was done to a large extent by unskilled labor.

How These Concrete Houses Were Built

The steel moulds were set up on the concrete footings and filled, forming the first course of the concrete wall. The concrete was mixed about the consistency of oatmeal. Ten per cent of Hydrated lime by volume of cement was added to the concrete mixture. The concrete was mixed in the proportion of one part cement, $2\frac{1}{2}$ parts sand and 5 parts of cinders. As soon as the first lot of moulds were filled, it was found that the first blocks moulded were firm enough so that the



End Gable Showing Attractive Finish of the White Stuccoed Walls

It is not an uncommon occurrence to read of a village of houses being reduced to ashes, but it is somewhat remarkable to see ashes turned into permanent fire-proof houses. This has been successfully done at Overlook Colony and also at Nanticoke, Pa., where a group of forty fire-proof houses were designed and built by me.

In the foundation walls of the Overlook Colony houses small stones from four to six inches were dropped into and imbedded in the concrete, as the moulds were filled. These stones displaced and saved from 30 to 50 per cent of the concrete. When properly bedded these stones did not show on the face of the wall, but were entirely covered in the concrete.

In this process of building, instead of the blocks, bricks or tile being moulded at a factory and shipped to the job to be set by skilled masons, the blocks of concrete were moulded in place on the wall, which did away with all of the manufacturing, transportation, breakage in handling, cutting to fit spaces around windows and the time required by masons for setting brick or tile. In this moulding method of building house walls, there is only the setting of the moulds and mixing and filling them with concrete, and this type of work can be done by unskilled labor, with one skilled foreman to direct the job. The advantages of this simple building process are quite apparent. As the moulds are in standard units, it is easy to utilize

the piece-work basis, paying the workmen a bonus on the moulds set and filled per day.

For the moulding of concrete houses there has been developed several different sized outfits of steel forms which are adaptable to different sized jobs. For the small job of one house in an isolated location, or for the small foundation job, there is a small No. 4 outfit. This is an outfit of only two moulds. It does not make the work rapid, as a drier mix must be used and the concrete must be thoroughly tamped in the moulds in order to make a dense wall, but has the advantage of requiring a minimum crew of 1, 2 or 3 men who can put up a wall. The cost of an outfit of this kind is \$60 and the weight is 200 pounds, including the attachments to build corners. A small mixer can be used with this outfit, or the concrete can be mixed on a board by hand.



Rear View of the Concrete Houses.
A 39 House Group.

No. 3 outfit has been described. This was the type used on the Overlook Colony work. The No. 2 outfit is for still larger work and permits the pouring of a course around the entire house in one operation. No. 4 outfit allows an entire story to be set up and poured at one time.

Fault has been found with some of the earlier concrete houses because the exterior appearance was somewhat crude, as compared with houses of brick or wood. The development of the White Portland Cement Stucco has changed this, and the concrete house of today is made the best-looking house, as well as the most substantial.

The white cement stucco can be given a rough or smooth "texture finish." It bleaches out and becomes more charming with age. These white, stuccoed walls form a delightful background for vines and evergreens. The general effect of this stucco is white, as is shown by the exterior views.

Cinder Concrete Walls Waterproofed With Portland Cement Stucco

The moulded concrete walls are made waterproof by the exterior stucco, which keeps out all dampness. In the Northern states these moulded concrete walls should be insulated against the outside cold just the same as walls of brick or tile. This insulation can be gained by stripping the walls before the lath and plaster is applied, just as is the practice with brick houses, or porous insulating block can be moulded in the middle of the wall, in which case the inside fin-



Concrete Houses Built With Steel Moulds

ished plaster can be applied directly to the concrete walls.

Where stone or gravel concrete is used, wood blocks are set in the concrete as the work is being done, to serve as a nailing for the interior finished woodwork. In the Overlook Colony houses and where cinder concrete is employed, these wood nailing blocks were unnecessary, as it was possible to drive nails into the cinder concrete much the same as into a wood block.

Moulding the Walls at Overlook

The door and window frames were placed in position as the work was done and the concrete moulded around these frames. This did away with all open joints and made a wind-tight, weather-proof house.

The reader will note that a sheet metal box was used to enclose the sash weight as shown by figure 9 and that this is a new idea in window frame construction. The frames were cut of standard size and came to the job knocked down. Figure 10 shows how the window sills were made weather-tight. The outside cement sill was moulded in place.

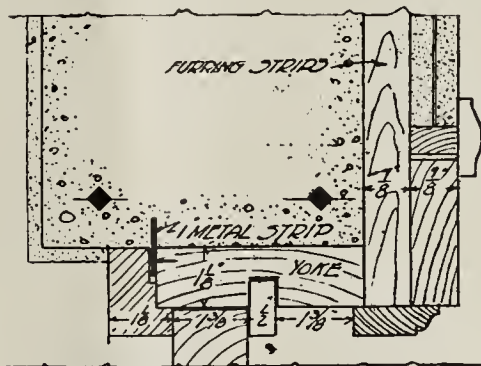


Fig. 8.—Section through window head in 6-inch wall. Windows in 8-inch wall similar.

Advantages of Such Construction

Concrete is not always the cheapest material with which to build, but it is the most permanent and least expensive in the long run. In many locations where sand and gravel are at hand or where cinders are obtainable, concrete has the added advantage of being the cheapest as well as the best construction to use.

These moulded concrete walls presented a very attractive appearance. They were first roughly moulded, and then given one coat of white cement stucco. This stucco not only makes the walls waterproof and gives a permanent wall finish, but saves future expense of painting, upkeep and repair. The wall of a concrete house is different from the house of wood, tile or brick, because concrete becomes stronger with age.

Window Frames

Figure 8 shows a vertical section through the window head. A strip of tin is tacked to the yoke and extends up into the concrete. This makes a joint that is air-tight as well as water-tight. A section through the side of the window frame is also shown. The sash weight box is formed by tacking a channel-shaped metal strip to the pulley stile. The sill and yoke are cut long, so that this metal weight box has a secure

nailing top and bottom. On account of the channel shape of this metal box, it makes a very rigid frame and is at the same time lighter and less expensive than the usual wood frame. (See Figure 9.)

The frames are made up with a reveal strip tacked on in place of the staff, as is shown in the detail. These temporary reveal strips build the frames out to the thickness of the walls, so that the frames, when completed, are set in the steel forms at any point desired, and the concrete poured around the frames, making a

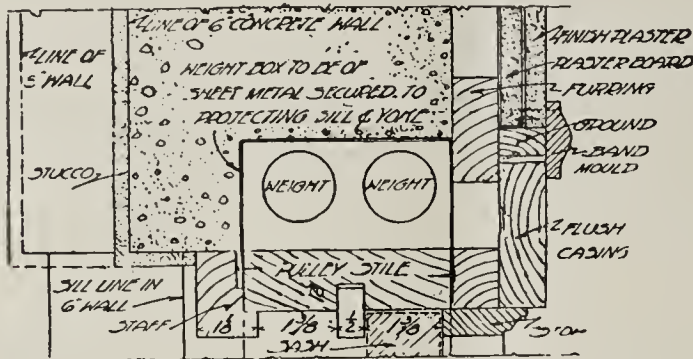


Fig. 9.—Section through window frame showing metal weight box

weather-tight joint. By the use of this simple metal weight box, the woodwork which is liable to shrink is reduced to a minimum when the concrete is poured around the windows. The temporary reveal strips are removed and the staff strip applied, which serves as a finish and forms the sash runway. The stucco is finished up against the staff. The reveal strips are made of 1 1/4-in. cypress, so that they may be used several times.

A sill detail is shown with a drip under the sash. The temporary reveal strips extend down below the wood sill and form a recess. The finished concrete sill is afterward molded in place. Wires are left projecting in the sill recess, which furnishes a secure bond. (See Figure 10.)

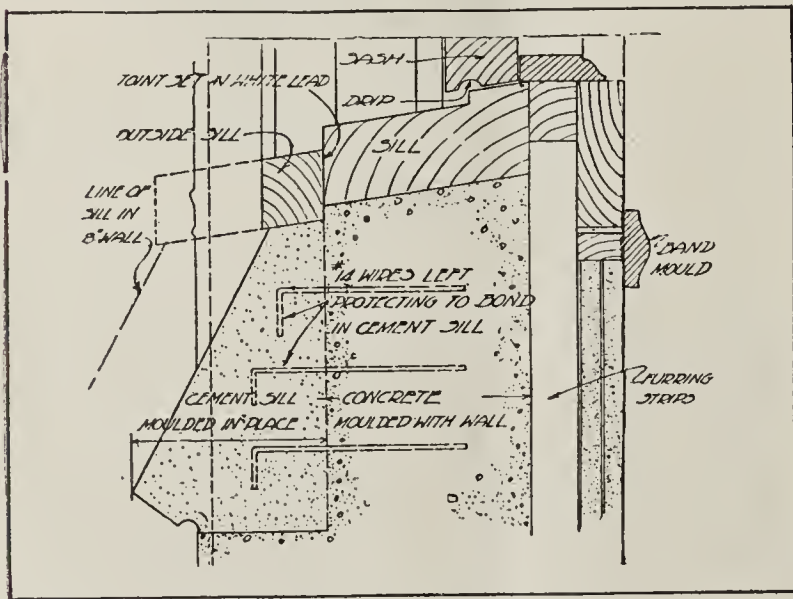


Fig. 10.—Section through concrete sill moulded in place

The outside wood sill is applied after the concrete sill is finished and so arranged as to extend down and over the joint between the main wood sill and the concrete. This outside wood sill is set with a white lead joint. While time is the best test of new structural details, such for instance as this window sill, it seems quite possible that it will eliminate one of the difficulties in concrete house-building—the making of water-tight window sills. The brick in the usual wall are so porous that they absorb any water

that beats in under the sill, but the concrete does not take the water so freely and this accounts perhaps for the fact that windows in some of our concrete houses have given trouble from leaks. As a rule the joints at the frames are more weather-proof in a concrete wall than in a brick wall.

Flush Trim

All of the interior finish in these concrete houses is set flush with the plaster, instead of projecting, as is the usual custom. This reduces the woodwork to a minimum and the flush finish largely eliminates the dust catchers. The woodwork receives the first coat of stain before it is put in place. It was the original intention to eliminate all grounds, as plasterboard was used, applying the same finish flush with the casing. The trim would without doubt be smeared over with plaster to some extent, but it was proposed to follow the plasterers up, cleaning off the trim, then applying a second coat of dark stain, which would cover up any stained parts, and finally to apply the band mould, much as a picture mould is put up in a finished condition. The wood base is also put up flush with the plaster, and the band mould extends along the top of the base and mitering up and around the doorways. The usual projecting stool at the windows is omitted.

All exterior walls are furred with 1 x 2's, 16 in. on centers. Furring strips are secured by nailing into the cinder concrete walls. Architects as well as contractors have been slow to realize the advantage of concrete in house-building.

Concrete the Standard House Material

The most progressive men can see that concrete will become the standard in house-building just as it has already become the standard for foundations, pavement and factory buildings.

The entire village of Overlook Colony of 201 houses was designed by Mr. H. Errol Coffin, architect, 1123 Broadway, New York. The details of construction of the concrete houses, as well as the new method of moulding in steel forms, was done under my direction.

Concrete Hollow Wall Building Blocks Must Meet Standard Test

The city of Rock Island, Ill., has declared war on manufacturers of cement blocks whose products fail to meet the standard test. According to Commissioner Frank Wich, the ordinance provides that cement blocks must be capable of bearing a pressure of 700 pounds to the square inch. Only a few products inspected recently have come up to the standard, he said.

Three manufacturers of blocks were ordered by Building Inspector John Lindlos either to bring their blocks up to the standard or quit business. They all said they would probably quit. Those ordered to raise the standard of their productions are Frank Perkins, Sam Slaterdowsky and John Scheuermann.

A Really Big Opportunity

Polk-Genung-Polk Co., with offices 706 Fisher Building, Chicago, is offering a splendid opportunity for the concrete man in the Polk System Junior. Every progressive builder is convinced that the favor of the concrete silo, corncrib, milkhouse, grain and water tanks, cisterns, garages and numerous other farm buildings can mean but one thing, and that thing is that concrete soon will displace all other building materials for these types of construction. The Polk System Junior consists of a form with which to mold circles of concrete into any height desired, with any openings specified.

Building Construction Under the Cost-plus-fixed-fee Contract

By A. E. Wells, President Wells Brothers Construction Co., Chicago

If a half dozen street urchins are caught by a burly representative of the law while engaged in the pastime of shooting craps, the law against gambling acts. Law makers have recognized that gambling is an unnecessary evil, and have, so far as possible, put a stop to it. Yet an owner and a contractor can gamble with a million times the stake of the street urchins without fear of the law and it is done constantly under the guise of the lump-sum contract.

For under its terms the contractor agrees that for a certain sum of money he will guarantee the owner against all the unknown conditions involved in putting up a structure. Whether he makes his figured profit or whether he loses so heavily as to be put out of business rests partly on his ability to figure costs, but largely on his luck in failing to meet those conditions which would increase costs.

Both parties to this contract stand to gain or lose. If the job costs 20 per cent more than estimated the owner gains to the other's loss. If conditions make considerable saving possible, then the contractor gains to the owner's loss.

Many contractors who in times past have built extensively in our field are no longer operating. Others have taken their place. Perhaps the majority of the missing firms are those who were expected not only to build according to specifications and within the time limit, but to gamble that their costs would fall within a fixed contract price. Gambling against variables such as the forces of nature and the conditions of labor—they lost. In many cases their failure involved an added investment on the part of the owner or possibly the surety company. It is certain that no one gained through the failure.

The contractor is an expert retained to assemble certain materials into a finished structure. The question being asked today is "should the contractor insure the owner that his structure will not exceed a definite contract price?" In competitive bidding the cost of this insurance is paid generally by the low bidder out of profits or, as frequently happens, out of his capital, for the reason that he is more likely to get the contract as he scales down his allowance for contingencies. In fact, the man whose bid includes a safe allowance for insurance against higher costs cannot expect to obtain work under the competitive bidding system. The inevitable result is the bankruptcy of many contractors and an additional cost to the owner or to the surety company to complete the unfinished contract. This situation has come to such a point that surety companies are refusing to write surety bonds on fixed price contracts except under specially favorable conditions and frequently recommend to owners the cost-plus-a-fixed-fee contract.

But from the owner's standpoint is it not preferable to know in advance what a certain project will cost? It is true that a careful estimate is due him. It should be made by a reliable contractor and checked by owner's architect and engineer. Such a figure should be more satisfactory than a competitive bid which does not necessarily show the cost of the building but only what some contractor is willing to gamble is the cost of the job.

An issue of bonds for an office building or other structure can as well be based upon a careful preliminary estimate in either case. It can only run below the estimate under the cost-plus-fixed-fee plan. Is not the owner entitled to the possible saving?

Additional financing may be an unfortunate necessity but is there reason why the contractor should be asked to under-write the accident of greater cost?

At the Chicago meeting of the Associated General Contractors of America, November 21, 1918, this type was discussed and Brigadier-General R. C. Marshall, Jr., chief of the construction division of the U. S. War Department, pointed out the fault of the usual pre-war basis of contract. He showed the impossibility on recent War Department work of asking for competitive bids, because speed was the essence and detailed plans and specifications were never complete at the time when construction must start. On such work it was, therefore, out of the question for a contractor to bid on a flat contract price basis. It would not have been fair to either side. As a result there was developed a form of contract known as the cost-plus-sliding-scale-fee contract.

General Marshall said that early in the spring of 1918 the program of work before the construction division was so extensive that it seemed advisable to have the merits of this form of contract again passed upon and a committee of eminent business men unqualifiedly endorsed this form of contract. In General Marshall's own words at the convention of general contractors:

"No contractor should be called upon nor permitted to undertake the performance of any contract that within the four corners of the paper upon which it appears is, or may be written the financial bankruptcy of the contractor. It is unjust, it is inequitable, it is uneconomic. The great lesson of this war on the subject of the relationship between the contractor and the owner is the cost-plus contract. This represents the only equitable basis under which a contractor may perform constructive and economic services for the owner. It is the only form of contract which affords protection to both parties. To me all the energies, the thought and the experience of this country within its own continental lines during the past year and one-half of this world struggle shall have been in vain unless out of it shall grow, as a permanent institution, solidifying the economic relationship between the contractor and owner, the cost-plus contract."

We have been operating under this plan almost exclusively for several years. We know that it is possible to convince most business men of the perfect fairness of the cost-plus contract and among our clients are several who would be the last to tie themselves up with us on any basis of contract likely to be unfair or dangerous. We have built on this basis for Montgomery Ward & Co., four successive times; for the Robert Simpson Co., Ltd., Toronto, five separate buildings, and for the William Davies Co., Ltd., Toronto, six buildings. For these firms we have been able to start actual construction much earlier than otherwise would have been possible, which means early occupancy. The reason for this is that we can start the foundations just as quickly as the foundation plans are complete and further design and construction may go on coincidentally.

Money tied up during construction earns nothing until the building is ready for occupancy and the interest often amounts to a considerable sum. When we have opportunity to work with the owner, architect and engineer from the very inception of plans and when we begin foundations as soon as the general contour of the building and equipment are determined upon, we are able materially to cut down the period during which the owner's capital is unproductive. Under the lump-sum contract it is necessary that the plans be complete before bids are taken, which may delay occupancy for months and without occupancy a building investment is poor as a dividend producer.

But while speed is of first importance in most building contracts, yet fairness to both parties is an equally good reason for its general adoption and on that basis our company is now operating almost exclusively. We feel that the owner should reap any benefit we are able to bring about. To give us incentive to make such savings we ask a moderate percentage of that saving under the estimated cost. Our standard contract calls for a return to the owner of 90 per cent of such savings, all of which would have accrued wholly to the contractor under the lump-sum plan. We believe 10 per cent of the savings to be an adequate incentive for the contractor. We have almost invariably made savings for the owner below the estimated cost on our cost-plus contracts and such savings have not been through the padding of preliminary estimates but through changes or economies in construction made with the consent of owner, architect and engineer, which produced either a structure more adaptable to its purpose or of lower cost with equal value. Such changes could be made only with difficulty under the lump-sum contract, as the average owner is averse to changing original specifications because of the generally high cost of "extras" or divergence from the original basis of bidding.

The cost-plus-fixed-fee basis has been adopted for the major manufacturing and merchandising operations. Automobile makers do not gamble with a fixed price, but from season to season vary their selling prices according as costs rise or fall. There is less of general price advertising than before the war and now many standard articles of commerce, once fixed as to price like the Ingersoll dollar watch, are today on a new basis and tomorrow may be higher or lower according as costs dictate.

Concrete Garage

Stahl-Finkle Company, concrete construction contractors, of Ellendale, North Dakota, have to know concrete building from the ground up, for they base their business reputation on the slogan—"Concrete for Permanence."

The garage pictured here shows they have done a good job. It will last—and so will the beauty of the pilaster and belt projections. Medusa waterproofed white cement was used for the exterior.

In speaking of their success with this product, Earl W. Finkle, of the company, says: "The color is very good—no sign of stain—and it is waterproof."

Mr. Finkle mentions other details of the garage as follows:

"This building was constructed with forms, made by 2-E Flexible Concrete Form Co., Eagle, Wis., which are very similar to the Van Guilder System, and build a wall with a continuous air space $2\frac{1}{2}$ inches wide. The outer wall is 4 inches thick and the inner wall 6 inches thick, with the usual $2\frac{1}{2}$ -inch air space between.

"Pilaster and belt projections are 4 inches. This construction seems ideal, for two walls are obtained with no connections whatever, save $\frac{3}{16}$ -inch rods for ties at intervals. The whole building has no mortar joints, and is practically as strong as of monolithic.

"The aggregate used for the walls was bank run material, not screened, and cement used in the proportion of $4\frac{1}{2}$ to 1.

"Both interior and exterior of building were plastered, and the panels outside were stuccoed on the plaster."

Where concrete is used for building trim, the "beauty spots" will always be free from stain if Medusa Waterproof White Cement is used.

Concrete Seedling Mile Now Under Construction in Ohio

Lincoln Highway Gap Being Constructed With Material Contributed by Association

The forty-first mile of the Lincoln Highway construction to be undertaken during 1919 in Ohio was started last week in Paulding County and will be pushed to immediate completion.

The odd thing about this mile is that it is the only mile of the Lincoln Highway in Paulding County. Between Van Wert, Ohio, and Fort Wayne, Indiana, the Lincoln Highway cuts through one corner Paulding County before it reaches the Indiana State line. It is just a mile from where the famous transcontinental road leaves Van Wert County to the points where it leaves the state, and this short section in Paulding County is, therefore, of no importance as a county road, with the consequence that it has been a difficult one to improve—the county itself refusing to take action to finance the work.

The Lincoln Highway Association contributed 3,000 barrels of cement to the State of Ohio in order that a permanent section of concrete construction could connect with the Indiana improvement, and in consideration of this assistance the State Highway Department is providing the necessary funds.

The cement for the job was contributed to the Lincoln Highway Association in equal parts by the Universal Portland Cement Company of Chicago and the Sandusky Portland Cement Company of Cleveland. Instead of the dusty and often muddy section of the Lincoln Highway connecting with the Indiana boulevard or greeting the East-bound tourists as the first mile of the Lincoln Way in Ohio there will, after this season, be a broad and perfect stretch of concrete paving.

Ohio has spent over \$1,422,000 on the permanent improvement of the Lincoln Highway this year.



Concrete Garage in Ellendale, N. D. The Wall Has Continuous Air Space $2\frac{1}{2}$ Inches Wide.

Hazards of Cement Manufacture

By R. Frame, Secretary, Central Safety Committee, Alpha Portland Cement Co.

A study of the causes of personal injuries in connection with cement manufacturing will disclose that the screw conveyor and sliding materials are always among the leading hazards. The Stock House and packing departments, having such a large proportion of these risks together with other dangers, are worthy of careful consideration.

Taking the experience of the Alpha Co. at eight stock houses and six packing rooms, during a period from Jan. 1, 1918, through July 31, 1919, they furnished about 8% of the total injured, the same percentage as to total days lost, and the only fatality on our records during the years of 1917 and 1918. Half of the men injured were compelled to go off duty. This runs close to the general average from the studies of the association.

A Binman's Fatal Accident.

With reference to a fatal accident, the employe (a foreigner) had been in our service over 2 years, and was following his regular occupation as binman in a small stockhouse in which the cement was stored on the bin plan. The employe was directed to do his work in Bins Nos. 5 and 6, each one having a capacity of 4,800 bbls. This certain afternoon there remained 400 bbls. in each bin which had to be hoed in feeding the cement to the screw conveyor. After loading one car of cement the foreman failed to receive an answer to his signal and upon investigation found that the deceased instead of working in Bins Nos 5 and 6, had gone over to Bin No. 3, where he could secure the required cement with far less real work on his part as compared with the hoeing he would have to do in the former bins. His portable light he left hanging in Bin No. 5. Working on a contract basis we think caused him to change from an almost empty bin to a full bin where he could have less wearisome working conditions, and his further neglect to afford himself ample light contributed to the recklessness resulting in his death.

Hazards of Stock Houses

Cement stored in bins presents greater danger to the workmen during the course of its removal than is usually found in the Open House.

At Martins Creek we have two types of stock houses. No. 1 has been partitioned off into bins where a known quantity of cement can be stored for special orders, tested and sealed, and to be drawn during the presence of the inspector who is sent to the plant to see that the cement in his shipment comes from this particular bin.

The capacity of the bins is as follows: 1 bin 10,000 bbls., 1 bin 6,000 bbls., 2 bins 5,400 bbls., (each), 1 bin 4,000 bbls., 1 bin 2,300 bbls. and the remainder of the bins each holding 2,600 bbls.

No. 2 Stock House is 270 ft. long, 73 ft. wide, and the walls are 39 ft. 6 ins. high. The capacity is 185,000 bbls. There are no bins such as described in Stock House No. 1, the cement being discharged at different points from the overhead screw conveyor and left to follow its natural course as it strikes below. This has been termed as "Open Stock House."

The storage bin has a limited capacity and while being emptied the cement tends to cling to the surface of the partitions and, therefore, gives the working face a steep pitch. When the cement is being disturbed it causes a flow, the workman must be on his guard in event of abrupt and heavy slides of material, which are very often the rule. The space in which the

man can safely do this work is limited, the bin may not have adequate natural or artificial lighting, the flow of cement creates a continuous dust, the man will have his entire lower limbs wrapped up with cement sacks that retard quick movements,—all of which increase the chances of injury. In case a man is covered up by cement it takes only a few moments for him to smother to death.

In an open stock house having tunnels the conveyors in which are fed by spouts and arranged at short distances apart, the cement that does not flow to the opening freely will remain in small low piles in the stock house. Men have plenty of room, more light, and better ventilation during the course of hoeing the cement.

When walking over the top of cement in an open stock house during the course of taking an inventory, care must be exercised against starting a slide. At one of our plants a Finishing Mill foreman, appreciating this danger, has been known to follow the chemist in the course of this inventory without the knowledge of the latter, so that he might be close at hand in case of accident.

Sometimes we find a small leak in the stock house roof or sidewalls, through which moisture will penetrate and reach the cement when the storage is well filled. In cleaning the last cement from the stock house, there is a danger from any cement which has hardened sufficiently to hold fast to roof supports, to other overhead construction, and to the sidewalls. At Plant No. 6 a formation which was clinging to the eave of roof fell and struck the binman across the back, causing a disability of 70 days' duration. Another man was injured in removing hard cement from the stock house sidewall.

A man was killed by a slide of cement caused by jar from the railroad. This brings to mind another source—the deep-well blast in the quarry. Every man should be ordered from the stock house during such blasting. Our experience shows that slides are induced by the accompanying jar. Particular care should be observed when working in freshly-ground cement, as it is known to move quickly and in heavy slides upon disturbance.

During the course of the removal of cement, the safe practice is to work not less than 2 men at any one time; to furnish a long rod and long handled hoe to start the cement, ropes where conditions permit their use, and careful instruction to men as to the danger should they undercut the cement to induce slides, together with a rule that hoeing should be begun from the top of the pile and the cement worked on the terrace plan. Compressed air is a good agency to start a flow of cement from a bin. The floor of the stock house between the tunnels, when constructed on an angle, will induce a greater free flow of cement. The Association Bulletin, of February, 1917, contained an account of the man in bin being furnished with an extension carrying a push button to signal persons on the outside when in danger.

Drawing cement in tunnels by reason of limited ventilation is a dusty occupation and there are numerous cases of cement getting into the eyes. A good design for tunnel construction is that described in the August, 1918, number of the Association Bulletin. We have the conveyors in the tunnels of one stock house set in a concrete trough which is built up from the floor and on one side of the tunnel so that the attendant cannot walk over the conveyor gratings. This gives room for thorough inspection, and is convenient in case of repairs. Where artificial light is

*Proceedings Eighth Annual Safety Congress.

required, due care should be given to keeping the system in good service.

All bins need strong iron ladders. These should be guarded, and connected with the ladder at different heights in the bin there should be working platforms protected by guard rails and toe board. This construction will give the workman a chance to go about his work more freely, and affords better safety. We had an employe who lost 49 days when, to avoid a slide, he jumped on a wooden ladder with such force that he broke the wooden rungs and fell into the cement. Last year a report was furnished the association of a fatality due to the bin collapsing. In this connection the construction of bins must allow for a liberal factor of safety. At one of our stock houses, iron columns in between which were inserted wooden planks were found inadequate, as the columns buckled and broke loose at the top fastening. An all-steel bin designed by the construction company's own engineer proved a failure in a near-by plant. When wooden partitions are used a liberal use of iron supports and a frequent inspection is advisable. Reinforced concrete makes very strong bin partitions. Since 1910 we have had them in one of our stock houses, built of 8-in. walls, 17 by 30 ft., for a bin of 3,000 bbls. capacity.

Recent storage construction shows the silo method of reinforced concrete to be in favor. Single containers, built high and narrow so as to promote self-emptying, with port holes through which to reach from the outside to disturb any cement that clings to the side walls, would remove many of our present hazards. In addition the tunnels connecting these single containers would permit all necessary openings direct to the outer air to secure good ventilation, better light, easy access, and a general improvement in present working places.

The dangers of a screw conveyor are too well known to require a lengthy review. Long ago the screw conveyor was indicted, found guilty, and sentenced for life behind strong iron bars, made up in form of a heavy grating $\frac{3}{4}$ -in. rods spaced at $27/16$ in. centers, secured to angles—3 by $2\frac{1}{2}$ by $\frac{1}{4}$ -in.—placed legs down, in sections 11 ft. 9 ins. long and bolted securely in place. This guard is your gas mask, and we must insist on the same recognition of its value by keeping it in place, as all soldiers who were compelled to have their masks on their chests ready for instant use. The cement industry can point to a long list of amputated limbs and fatalities caused by the lack of appreciation of the awful dangers of screw conveyors and the necessity for the best guards and inspection service to overcome this menace in every department and in every location in the plant.

To eliminate further danger and dust, a $\frac{1}{4}$ -in. thick plate, the full width of the conveyor and covering the entire length, excepting such places where material is inserted, is added. The plate is fastened with bolts to the grating angles.

Hazards of Packing and Loading.

In the packing room, the Bates machines need guards on the main drive belt, the gears, the pulleys on the bin feeder drive, and the eccentrics in back of machine. Our records show one man lost two fingers in the gears and another had a close call from fatal injuries by having his clothing caught on small feeder drive pulley which had a piece broken from flange. Twenty per cent of our accidents in the packing room and stock house are due to cement spurting into the face and eyes of the operator on Bates machines, due to a bag bursting or a small hole bursting or a small hole in same. Only a small percentage of our employes will wear goggles.

I have been advised that a member company follows a practice of having a small equipment at the stock house for giving immediate treatment—only an eye wash—as soon as a man get cement in his eye, claiming that if the chemical action of the cement is neutralized immediately the usual burn will be prevented. They have now followed this method about 8 months and during that time have not lost one single day from a cement in the eye accident.

On hot days in packing freshly-ground cement, the men often experience chafing of the arms and fingers. Our experience has been that there is a good deal of lost time on this account and the extent of this disability may escape attention because the ailment is not classed as an accident and, therefore, the same complete reports of the full facts are not received and kept on file. The decisions under Compensation Laws have been so liberal to the claimants that we may expect to be required to pay compensation for a serious infection or death resulting from this cause. We hope the medical department of some member company can offer an ointment that is quick-healing and antiseptic, to be kept on hand for immediate use in case of chafing and the men educated to obtain prompt treatment, as a means to reduce this lost time.

The question of dust control in the packing room is in the mind of every manufacturer. State factory inspectors have registered a criticism on working conditions, and who knows how much longer the workman will tolerate them.

The Security Lime & Cement Co. is reported as having secured good results with an installation of the Bates Valve Bag Co. which produces a draft and collects the dust so successfully that the air in this department of the Security's plant is practically free from cement dust. The Alpha Co. is about ready to try out a collecting system, recently designed.

Trucking has its hazards in men striking their hands, slipping on the floor, upsets, and when passing over the runway. New men need instruction as to proper methods in handling a truck.

The shifting of cars at packing rooms has its dangers. Failure to give the workmen proper notice before the shift is started, neglect of the men to heed the warnings, cars breaking loose, men crossing in front of and jumping on cars, are responsible for accidents. At one plant where the tracks to packing room are on a grade, we have derailleurs and the crew must give the packing room full notice of a shift about to be made before the cars can pass the derailer.

The stock bins and overhead walks require the standard guard rails with toe boards. A fatal injury on our record shows that while engaged in conveyor repairs over the bin a bar slipped and caused the man to fall from the platform on top of bin. The same standard guards that are generally used in other departments of the plant will afford necessary protection to belts, pulleys, gears, sprockets, chains, clutches, and electric apparatus which make up the general machinery hazards. Care should be exercised to see that machinery, particularly that in tunnels and elevators, is equipped with locks to prevent starting up without notice while men are working in positions where they can be caught.

Education of the workmen in safe practices has a large field in the stock house and packing rooms as it takes time to train new men and because of the importance of having an efficient crew on duty each day to load your cement promptly and, therefore, have it arrive at its destination in shape satisfactory to your customer.

Most Recent Development in Cement Plant Potash Recovery

Since the signing of the armistice, and the uncertain future of the American potash industry has become so apparent, the interest in potash recovery at cement plants has waned considerably. During the year 1918, however, great strides were made in the cement industry in the way of potash recovery and it is to be regretted that the future of this branch of the industry should be threatened and progress arrested, even if only temporarily.

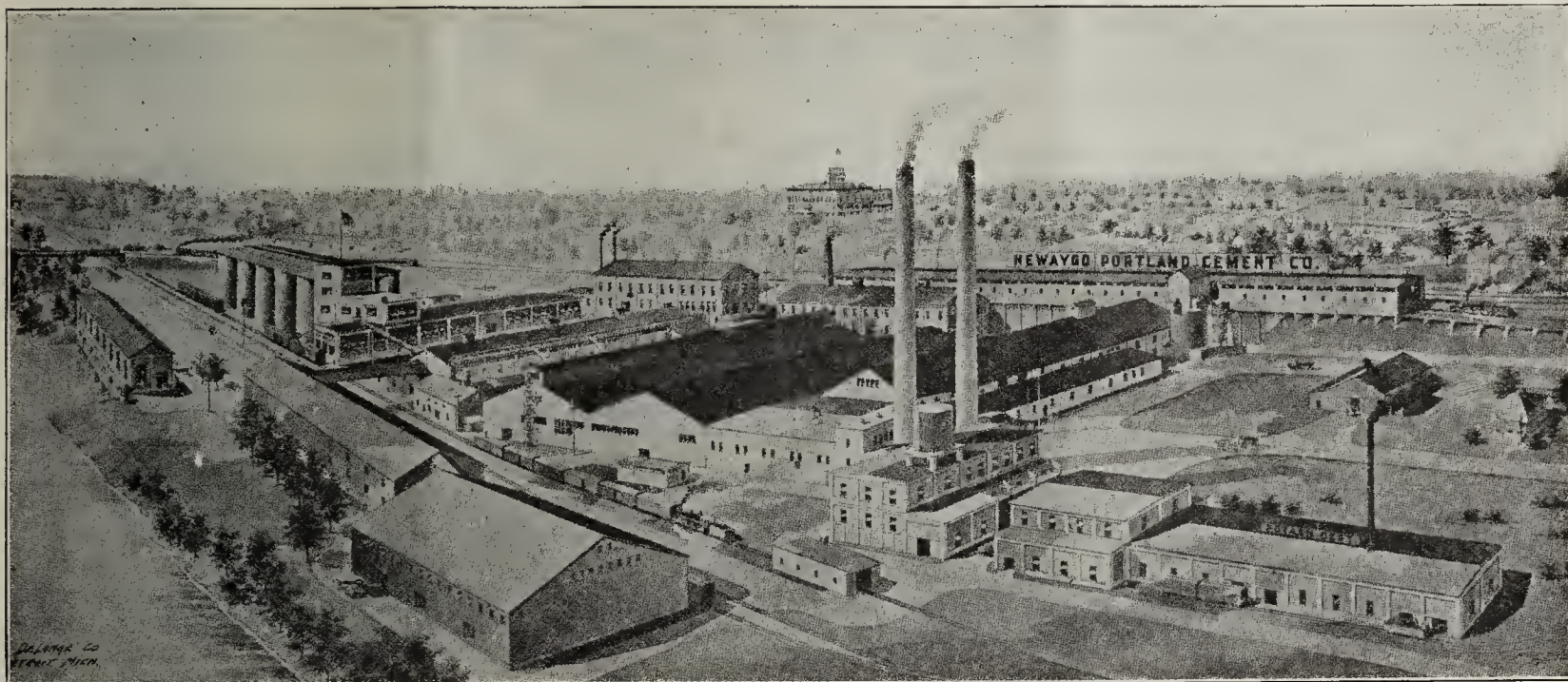
One of the last cement plants to install a potash recovery system under war conditions is the Newago Portland Cement Co., Newago, Mich. This plant was designed to produce a very high grade product which is especially adapted for the chemical industries

which the fine dust has been recovered. From the Dorr thickener the liquor is drawn off to evaporating pans, while the sludge is drained to a sump, from which it is pumped to two filters.

The filters reduce the moisture content of the sludge to about 34 per cent. The liquor, or filtrate, is pumped to the evaporating pans, while the sludge is scraped off the filters to be re-used in the kilns.

Sludge Returned to Kilns

When the dewatered sludge or filter cake leaves the filters it falls into a collecting trough from which it is removed by a screw conveyor and taken to an adjoining pug-mill. Fresh water is added and the sludge is



Plant of the Newago Portland Cement Co., Newago, Mich., Showing Potash Recovery Plant in the Foreground at the Right

and on this account will doubtless prove a profitable investment even in the face of foreign competition.

Richest Raw Materials

The raw materials used to make Newago cement are claimed to run the highest in recoverable potash of those used at any cement mill in the United States. This is 1.55 per cent of potash salts. Shale and limestone are the ingredients, the shale running as high as $4\frac{1}{2}$ to 5 per cent potash.

The wet process of cement manufacture is used. The kilns are 9 ft. in diameter by 180 ft. long. The average temperature of the kiln gases is reduced to 400 deg. F. before applying the Cottrell method of potash recovery.

Gas Taken Direct From Kilns

In some of the older plants the kiln gases are recovered after they have entered the stacks. At the Newago plant the kiln gases are taken direct from the end of the kilns and are by-passed around the stacks in rectangular concrete flues, as shown in the accompanying views.

Before entering the Cottrell electrical precipitator the gases are passed through a spray of cold water, which reduces their temperature to about 400 deg. F. and removes the coarser materials, such as ash.

The Cottrell precipitator is built of reinforced concrete in three units and operates at 100,000 volts. The liquor discharge runs to a sump, from which it is pumped to a Dorr thickener 36 ft. in diameter and 11 ft. high.

De-Watering the Sludge

The Dorr thickener removes about half the water in

remixed to the consistency of the slurry used in the kilns.

By means of an air-lift pump in the filter house, this sludge or slurry is pumped back into the kiln feeds, thus preventing the loss of any potash which could not be recovered from the filtrate. The potash content of this sludge runs as high as 3.59 per cent. It is, of course, again volatilized in the kilns and a part is recovered in the next trip through the recovery system.

The other contents of the filter cake are silica, 33.72 per cent; iron and alumina, 34.94 per cent; lime, 7.8 per cent; sulphur trioxide, 12.59 per cent; magnesium oxide, 1.03 per cent.

About 15 tons of flue or kiln dust is treated per day, of which 12 tons is returned to the kilns in the form of filter cake.

The evaporation of the liquor carry-coal being used for firing. The circulating liquor carries about 45 per cent of potash.

Evaporation is done in two stages. Experiments have also been made with centrifugal dryers.

A sample of the average salt recovered is as follows: Silica, 0.36 per cent; alumina and iron, 2.69; ferric (iron) oxide (Fe_2O_3), 0.03; lime, 2.53; sulphur trioxide (SO_3), 14.62; chlorine, 23.40; and potassium oxide (K_2O), 41.42 per cent.

Plenty of Electricity

The Newago Portland Cement Co. enjoys the rather unusual advantage of a surplus of cheap electricity. The company has its own very modern and well equipped hydro-electric power plant, which furnishes all the motive power for the mill and the cur-

rent for the Cottrell precipitator, and still leaves a larger surplus than the small city of Newago can use.

Designers and Builders

The vice-president and general manager of the company under whose supervision the potash-recovery system was installed is J. B. Jonn. The chief engineer of the company, to whom credit for many details is due, is L. E. Smith. F. S. Moon was the engineer representing the Western Precipitation Co., of Philadelphia, which installed the Cottrell electrical precipitation.

The raw materials from which Newago cement is made are purchased from the Petoskey Stone Co., which operates quarries and crushed stone plants at Petoskey in northern Michigan. The crushed stone and shale are brought by rail a distance of about 90 miles.

New Plant of the Eau Claire Sand and Gravel Company

A simple and compact conveying and washing plant has been erected at Eau Claire, Wis., by the Eau Claire Sand and Gravel Company. This town is located right in the midst of one of the most extensive sand and gravel deposits in Wisconsin. Already vast inroads have been made in these deposits, both for local construction work and for shipment to other localities, but the present plant represents the newest and most modern installation in the district.

This new plant has a capacity of 500 tons of finished product per day, and is located on a 100-acre tract owned by the company and comprising a particularly satisfactory deposit for sand blast work and roofing



Conveying and Washing Plant Eau Claire
Sand & Gravel Co.

gravel, with the larger sizes screened out for concrete work of various kinds.

The primary handling of the materials is done by means of a Williams Porto-Crane. This crane is mounted on a self-propelling truck, carries a 30-foot boom to which is attached a half-yard bucket, and has 6½x10-inch double-cylinder triple friction-drum hoisting engine and boiler, also independent swinging and traction engine.

This crane handles the material at the bank and dumps it into a hopper at the bottom of the incline shown in the illustrations. From this point it is conveyed to the top of the bins by means of a 5-ply Diamond Rubber Company's belt conveyor 20 inches wide. Here it passes through two screens to separate the sand, gravel and stone, the gravel and stone being thoroughly washed while being separated.

The sand is then carried by means of a steel chute to six Richards hindered settling classifiers, furnished

by the Allis-Chalmers Manufacturing Company, of Milwaukee. Two of these are three-spigot classifiers and four of them are one-spigot. Here the sand is thoroughly washed and separated into three grades—20, 30 and 40 mesh—and deposited in bins.

The reinforced concrete bins have an inside diameter of 16 feet, with 6-inch walls. The vertical reinforcing consists of ½-inch twisted rods placed on 20-inch centers, with circumferential rings of ¾-inch twisted rods spaced at distances to meet the varying pressure at different heights. The tallest of the bins is 35 feet 7 inches from the grade line, and the shortest one is 4 feet lower.

The hopper pit is constructed of concrete to the ground line and timber framing above ground line. The trestle incline is built of timber on concrete piers, and the framing is extended over the bins for supporting the screens, belt pulleys, classifiers, water tank and piping.

The galvanized iron tank on top of the concrete bins is filled by means of a centrifugal pump, supplying water from an open well at a rate of 750 gallons per minute.

Power is supplied to the plant by two Westinghouse Electric motors, one of 25 and one of 35-horsepower capacity.

Each bin is provided on track side with a hinged chute for the loading of cars, and three of them also have additional chutes on the opposite side for the loading of trucks.

The following analysis of the material owned by this company was recently made by Otto J. S. Boberg, pharmacist and analytical chemist:

Loss on Ignition	.37
Silica	88.79
Iron Oxide and Alumina	9.67
Calcium Oxide	.88
Magnesium Oxide	.29
	100.00

The officers of the Eau Claire Sand and Gravel Company are: F. E. Nichols, president; C. L. Tolles, vice-president; George W. Robertson, secretary and treasurer.

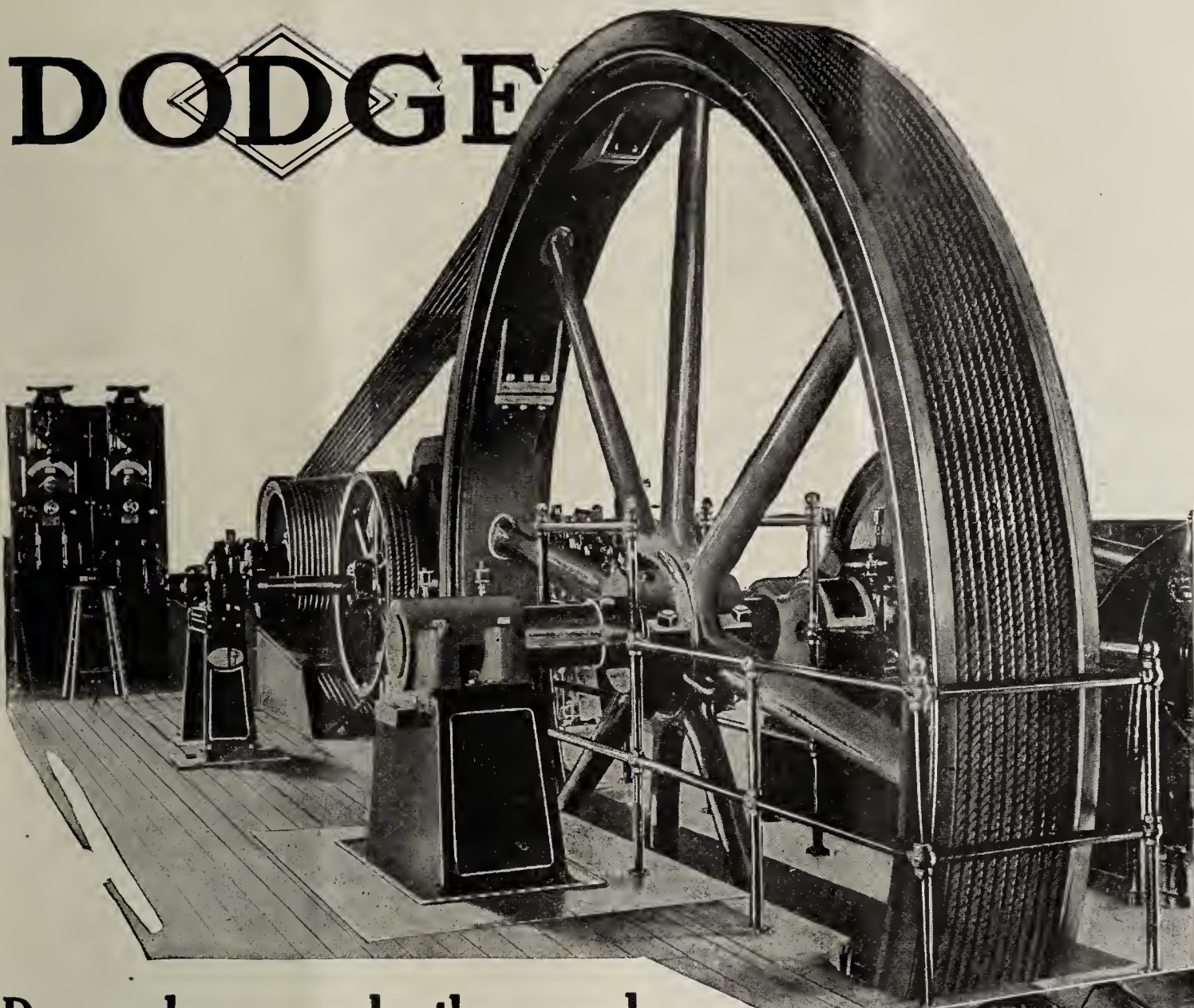
Vulcanite Cement Company to Resume at Mill

The Vulcanite Cement Company, Phillipburg, Pa., is preparing to resume operations at Mill No. 2, which has been closed for the past eleven months. The machinery is being overhauled and being put in readiness for the resumption of the turning out from 1,500 to 2,000 barrels of cement a day. Mill No. 3, which has been operated steadily since its construction, has a capacity of 3,000 barrels a day and this is the most modern plant the company owns.

An important part of the getting ready of No. 2 will be the installation of new belting throughout the plant. Some new additional machinery has been ordered. This mill will give employment to from 100 to 125 men and the company is now trying to engage the force. The company hopes to get ready to manufacture and start up this month.

No. 1 mill, the first constructed, has not been operated for several years. The expected boom in cement is here, local manufacturers say, and other mills are arranging to increase their output.

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Do you buy rope by the pound or belt by the inch?

In any shop the prime mover is either a rope or belt drive. When a Dodge rope drive can be used, the service is more nearly continuous and the upkeep cost lower.

The belt itself constitutes the larger portion of the cost of a belt drive; while in the case of a rope drive the rope is the least expensive part of the installation.

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The economy of buying Blue Strand Manila rope by the pound against replacing belt of excessive width is immediately apparent — and the rope delivers more nearly 100% of the engine power than does the belt.

Complete freedom from tightening and lacing heavy belts with the attendant shutdown to production is another big argument in favor of a Dodge rope drive as a prime mover.

There are other points of superiority shown in our book "25 Years of Rope Driving". Send for a copy and see for yourself the application of Dodge rope drives to each industry according to the particular requirements of that industry. It is free to the engineer or master mechanic of any industrial plant.

Dodge Sales & Engineering Company

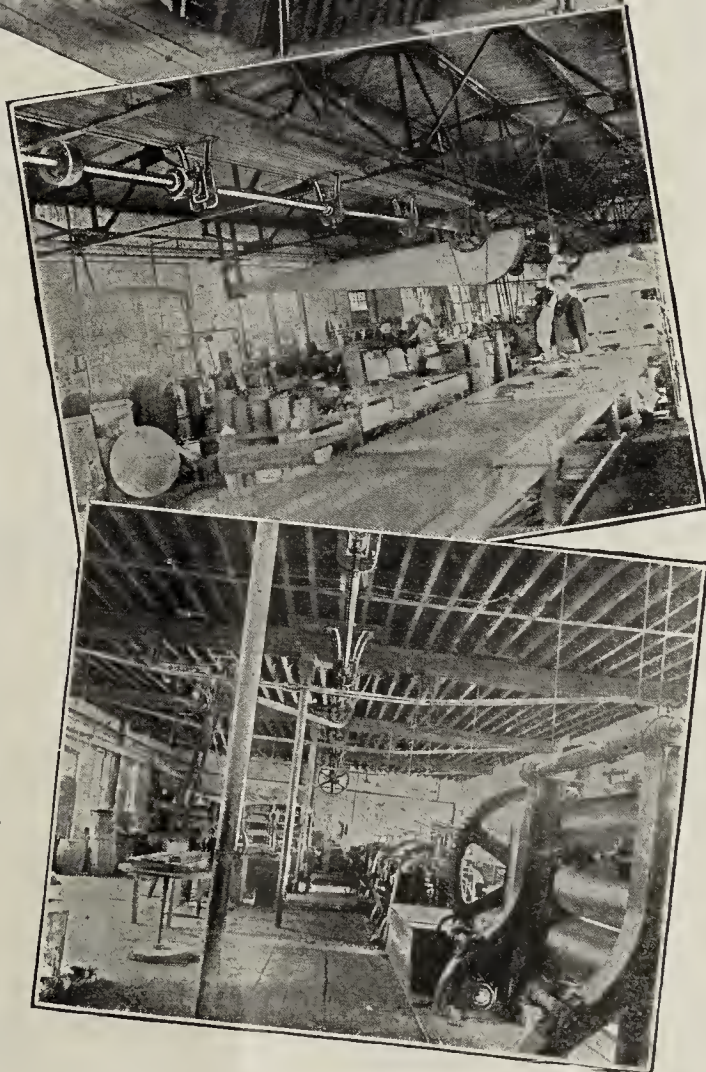
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The Problem of Waste Heat Recovery in Cement Mills

By H. D. Boylor, Chief Engineer, Louisville Cement Company.

It is to be hoped that the lessons so dearly learned during the war will not be forgotten with the conclusion of peace, and that the possession of ample sources of raw materials will not tempt us to continue wasteful practices in any line of industry.

The problem of fuel waste is certainly one of primary importance, for in no line has there been greater waste than in the use of fuel for both domestic and industrial purposes. In the use of fuel for domestic purposes we naturally expect more or less waste, due to the inefficiency of both the operators and appliances. However, in the case of the manufacturer, whose fuel account mounts into the thousands of dollars, we have reason to believe that he is or at least ought to be vitally concerned in fuel conservation. Yet with all this in mind, we see that it requires a bit of education in fuel economy for the ones responsible for the plants consuming the coal as fuel, in order that they may operate and adapt efficient apparatus to effect the necessary saving. We as cement-makers carry a good share of this responsibility, therefore it is up to us to assume a leading part in this national problem.

Generally speaking, I think I am safe in saying that of all the coal used in the various steps of cement manufacture, only about 50 per cent of the actual fuel energy is utilized; the greater portion of this low efficiency being caused by the great heat loss in rotary kiln operation. I take it that there are very few plants at the present but what have installed fuel saving devices in their boiler plants, such as modern stokers, feed water heaters and economizers. But comparatively few have made any attempt to save fuel or to recover the waste-heat in the gases of combustion from the rotary kiln, and it is to this particular phase of fuel conservation that the writer desires to direct your attention.

When we, of the Louisville Cement Company, in conjunction with engineers of a large boiler manufacturing company, first took up the problem of waste heat recovery, some four years ago, we made a very careful study of our then existing conditions. And we soon learned that we were not only losing one-third of our actual heat out the stack, but we were at the same time admitting and heating twice as much air as was actually needed for combustion. We also learned that our irregular coal feed on the kilns was the source of considerable heat loss. So as is usually the case in such investigations, the one step to reclaim the stack heat losses soon led to other steps, which, while they were secondary to the original problem, were at the same time quite important.

Our data taken before the installation of the first waste-heat boiler were worked out on two kilns 10' x 150', dry process, and using coal as a fuel. The average result being somewhat as follows:

Fuel—Eastern Kentucky coal—13300 B. T. U.
Kiln Output—900 bbls. each kiln per day.
Coal used per bbl. clinker burned—110 lbs.
Temperature air entering kiln—100° F.
Temperature of escaping gases—1000° to 1400°.
Stack draft—0.34 in. water.

Stack Gas Analysis:

Carbon dioxide	8.6
Carbon monoxide	0.0
Oxygen	14.0
Nitrogen	77.4

A careful study of general working conditions led us to the conclusion that the heat received by the kiln was distributed as follows:

- | | |
|---|-------|
| (a) Heat required to decompose carbonates and form clinkers | 37.6% |
| (b) Heat carried out in hot clinker | 10.6% |
| (c) Heat carried out in stack gases | 35.5% |
| (d) Heat lost by radiation and conduction ... | 16.3% |

It will be noticed that in our original tests our stack gas temperature fluctuated from 1000° to 1400° F.; this was due in a large measure to our irregular coal feed. This difficulty we overcame by the rearrangement of our coal hopper, so as to avoid a banking of the pulverized coal in the hopper. The flue gas analysis indicated very clearly that we were admitting quite an excessive amount of air; this we overcame to a large degree by the building of a large air manifold on the hood, and at the same time arranging to draw the air for combustion over the hot discharged clinker, so that at present fully 75% of the air used in the kiln enters at a temperature of 350° F.

The first waste-heat boiler, which was erected to handle the waste gases from the two 10' x 150' kilns, had a rated horse power of 1,500, with 15,300 sq. ft. of heating surface, and originally 1,382 sq. ft. of superheating surface; but due to the close spacing of tubes in the superheater, as first installed, we had trouble with the dust caking between the tubes. This difficulty has been overcome by eliminating one-half the tubes, thus cutting the superheating surface to 691 sq. ft. The boiler is equipped with a turbine driven fan of ample capacity to handle all the waste gases and overcome the friction through the boiler and gas conduit, and still give plenty of draft for the kilns. The turbine driving the fan is rated at 280 h. p., but on an average it will consume about 135 h. p., the drive being made by means of a reduction gear.

The dust accumulation on the tubes is blown off by means of a soot blower twice every 24 hours. There is quite a saving of dust, due to the settling out in the long gas flue and under the boiler, this dust being drawn from the hoppers forming the conduit bottom once every 24 hours.

Before the erection of the boiler the kiln draft was obtained by means of stacks, each kiln having a stack 60' high and 11' in diameter, our maximum draft under these conditions being 0.34", and as previously stated, our average output was 900 bbls. for each kiln. By means of the boiler fan we were enabled to increase our draft to most any desired point, but after a great deal of experimenting we decided that for our conditions 0.45" draft was the most efficient; this gives us a daily average of 1,250 bbls. for each kiln and nets us near 1,050 h. p. on the boiler without sacrificing anything in fuel economy. We made a number of experiments, carrying the draft as high as 0.60", and by so doing were able to increase the kiln output to 1,400 bbls. per day and develop 1,350 gross h. p. on the boiler, but we did it at quite a sacrifice in coal. Or, in other words, it indicated to us that with our prevailing mill conditions we were attempting to feed more coal to the kilns than they could burn efficiently. Hence it has been our practice to operate the kilns at the most efficient point as to output and fuel consumption, without any regard to the boiler, so that we may say that the boiler as operated is strictly a waste-heat apparatus.

The following resume made up from a large series of tests, will give some idea of the general working conditions of the boiler as operated at present. All temperature readings being in degrees F., and draft in inches of water.

Mr. Contractor:

Jiffy Labor-Savers Make Money for You

Wood shoring costs approximately $3\frac{1}{2}$ cents per square foot of floor area. **JIFFY ADJUSTABLE JACKS** easily do the same work—and do it better—for *less than 1 cent per square foot*. This saving will help secure contracts.



Jiffy Jacks are here shown making money for Fred Drew, Inc., Woodward Bldg., Washington, D. C., on the Kennedy Apartments. Jacks are set full height under 14-inch floor slab.

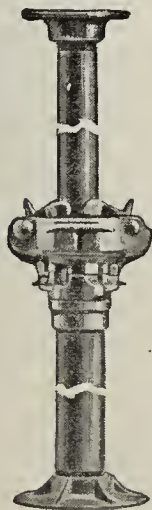


Jiffy Double Head Jack for flat slab work.



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Jiffy Panel Jack for temporary work or reshoring.



JIFFY Column Clamp Also Means Bigger Profits

Simplest and quickest to set. Requires no wedging. No dead space in its adjustment. Automatically squares column. Positively closes all cracks. Also made for round columns. No small parts to get lost.

WRITE FOR FACTS AND PRICES

Paul W. Koch & Company, Lees Bldg., Chicago

Temperature of atmosphere	60° F
Temperature of raw mix fed to kilns	190° F
Temperature of pulverized coal fed to kilns ..	160° F
Temperature of air in kiln room	80° F
Temperature of preheated air entering kilns for combustion	350° F
Temperature of discharged clinker	1800° F
Temperature of waste gases at back of kilns.	1350° F
Temperature of waste gases entering under boiler	1275° F
Temperature of gases at top of first pass of boiler	675° F
.....	ELEVEN
Temperature of gases at top of second pass	720° F
Temperature of gases at bottom of second pass	600° F
Temperature of escaping gases	426° F
Temperature of saturated steam	361° F
Temperature of superheated steam	510° F
Draft at boiler stack breeching	6.80 in.
Draft at rear pass top	6.20 in.
Draft in second pass bottom	5.30 in.
Draft in second pass top	3.95 in.
Draft in first pass top	3.55 in.
Draft in first pass bottom	1.37 in.
Draft in kilns entering flue	0.45 in.
Steam pressure in pounds	154
Coal used per bbl. of clinker	94.7
Bbls. of clinker per 24 hrs. each kiln	1250
Gross H. P. developed on boiler	1160
Net H. P. obtained	1025
Flue gas analysis of gases entering under boiler:	

Carbon dioxide	16.8
Oxygen	8.6
Carbon monoxide	0.0
Nitrogen	74.6

Under the above working conditions the two kilns receive about 155,000,000 B. T. U. of heat per hour, and of this total approximately 55,000,000 B. T. U. are carried out as waste heat to the boiler. This heat as received by the boiler is distributed somewhat as follows:

(a) Absorbed by boiler	70.5%
(b) Carried out by boiler stack gases	27.6%
(c) Lost by radiation (by dif- ference)	1.9%

Therefore, taking the two kilns and waste-heat boiler just described as a unit (this being the unit upon which we made very exhaustive tests), we have increased our heat utilization from 37% to 67%.

In the installation of the second boiler of similar construction a few minor changes were made in order to facilitate its mechanical operation. It being set much closer to the kiln discharge, thus eliminating a part of the friction and heat loss, it is also built well above ground, to permit of large dust settling chambers under the boiler. The fan being of the turbo-vane type, instead of the radial blade type, as used in the first installation. This change gave us a more economical drive from a steam standpoint, but at the same time this gain was counterbalanced by the trouble it gave due to the collection of dust on the vanes, necessitating frequent dusting during operation. This boiler receives the waste gases from two kilns 8' x 125', and gives a net boiler horse power of 500. With the two boilers in service we are recovering approximately 1,500 boiler h. p. that we might say was absolute waste before the boilers were installed.

This saving can perhaps be more readily understood by a glance at some figures taken from our boiler room

fuel report. Prior to the installation of the first waste-heat boiler, it required 91.7 lbs. of coal in the boiler room per barrel of cement. With the first boiler in full service the coal consumption dropped to 40.2 per bbl., and during the past year, with both boilers in operation, the coal used has fallen to a much lower figure, being 21 lbs. per bbl. manufactured, it being necessary to keep only two of the regular stoker boilers floating on the line to pick up the load in emergencies. Considering the same figures from another angle, we see that our fuel saving per barrel manufactured shows approximately 70 lbs., taking our annual production at 800,000 bbls., we find our total coal saved per year amounts to 28,000 tons, a saving which I feel sure you will say is quite worth while.

Considering the same from a nation-wide standpoint, with the annual 100,000,000 bbls. production, the conservation effected, if it were possible for all mills to make a similar reduction in their fuel tonnage, would be of such magnitude as indeed to lighten the burdens of Dr. Garfield and his worthy assistants. Without a doubt the time is fast drawing near when we shall have a permanent department of fuel administration, whose duty it will be to see that industrial organizations shall adopt efficient methods in the operation of their power plants, thereby not only effecting a saving for the plant owner, but of far greater importance conserving a vast store of energy for future generations.

Cement in the Northwest

"We are looking for the biggest cement business this fall we have ever experienced," says F. T. Brown, manager of Lehigh Portland Cement Company, of Metaline Falls, Wash. "Indications are that cement work to be done this fall will keep the factories running at capacity."

The capacity of the company's plant at Metaline Falls is 2,000 barrels per day, and it is expected the needs of the northwest will take the entire supply.

"We are now shipping 1,000 barrels of cement a day to points in Washington, including Yakima, Colville and Wenatchee, and as far east as central Montana," continues Mr. Brown. "Our cement is being used on the Apple Way, near Spokane, at present, as well as on the state highways."

According to Mr. Brown the company is somewhat handicapped by the lack of freight cars.

On the whole the outlook for the fall is very good and cement men generally are looking forward to a good increase of demand. Cement and concrete are daily springing into favor for highway work.

New Monarch Stave Silo

There is not a farmer in this country but is now convinced that he needs a silo. A lot of them have been able to have silos built, but more of them have not been able. This last year crops were better than ever before, and the amount of money for improving the farms is larger than it has ever been before. The farmers all are going to have silos just the moment they can—it is simply a question of selecting the best.

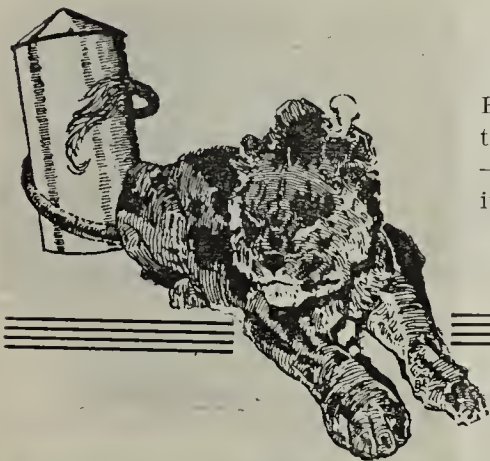
The New Monarch Machine & Stamping Co., Des Moines, Iowa, have a system of concrete stave construction which offers many advantages both to the builder and to the man who will own the silo. But little capital is needed to start in the manufacture and erection of New Monarch stave silos, and the profits are most satisfactory.

Big Money In Silo Building—We Start and Back You

Farmers have ready money—they will build more silos this year than ever—now is the time to get started in this profitable business. We give you some genuine assistance in manufacturing, help you sell, even aid you build the first silo or two. No experience is needed—the first two silos pay for entire equipment.

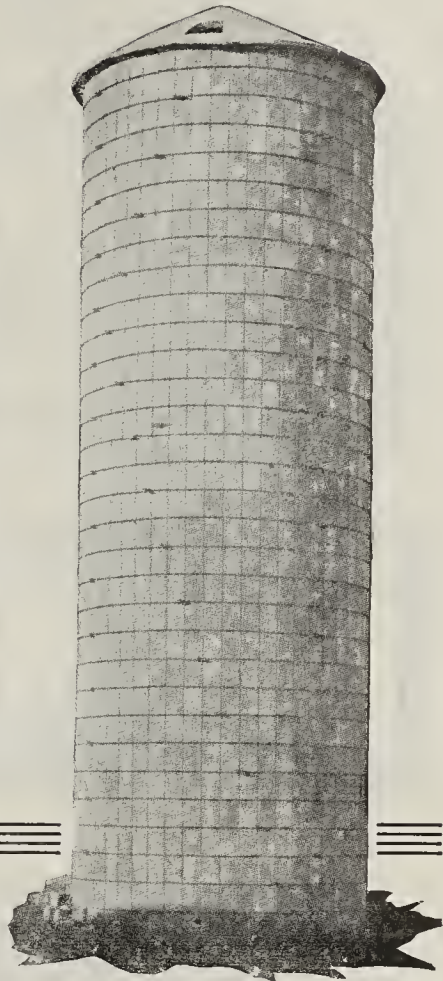
Experienced Silo Builders, Enlist Our Aid

The more you know about the silo business the more you will appreciate the value, quality and service we give with our silo machines, equipment and hardware. And more—we help you sell more silos—extend every legitimate effort toward making your business more profitable.



Valuable Facts—Free

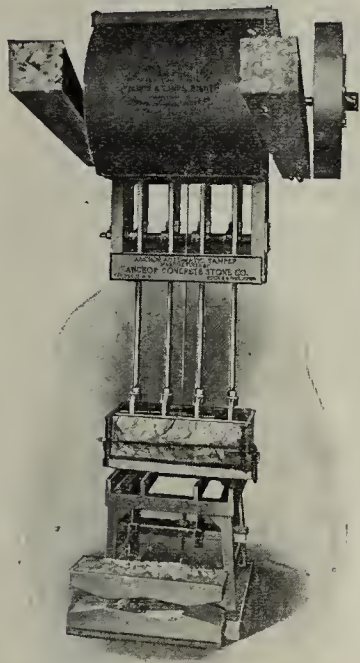
For the asking you may have figures on the cost of production and construction—selling prices based on various profits—and complete catalog. Ask to-day.



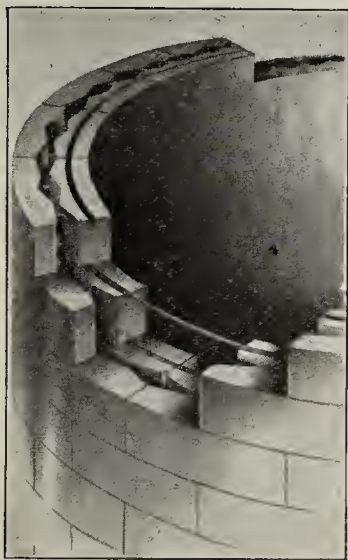
New Monarch Mach. & Stamping Co.

S. W. 9th and Murphy Sts.

Des Moines, Ia.



ANCHOR



Anchor Tamper over Anchor 24" Building Block Machine

Anchor Continuous Air Space Silos Are Frost and Moisture Proof

Anchor Ventilated Corn Crib. Two Blocks made each operation. Each Block 24"x4"x8"

One Anchor Block Machine with a few attachments makes all of the above types of blocks and several others. The same Anchor Tamper tamps them all. Any block with cement connections will conduct frost and moisture. The Anchor Block will not.

ANCHOR AUTOMATIC TAMPERS

are built to operate over any make of BLOCK, BRICK, or SILO STAVE Machine. Guaranteed to give satisfaction. This tamper seldom, if ever, needs repairs. We justify this claim by guaranteeing to furnish all repairs for THREE YEARS absolutely FREE.

For catalog describing our Block Machinery, Tampers, All Steel Silo Doors, Silo Scaffolds, etc. Write

ANCHOR CONCRETE STONE CO.

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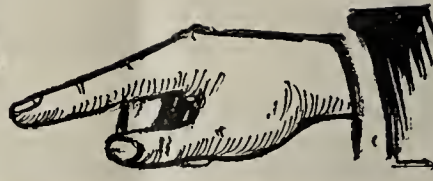
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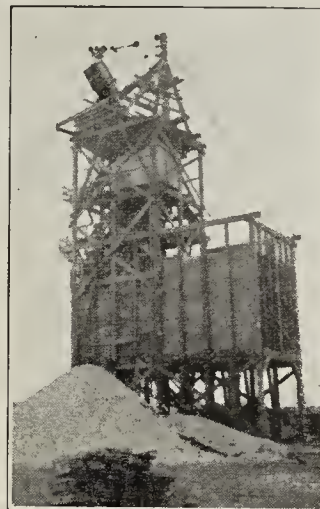
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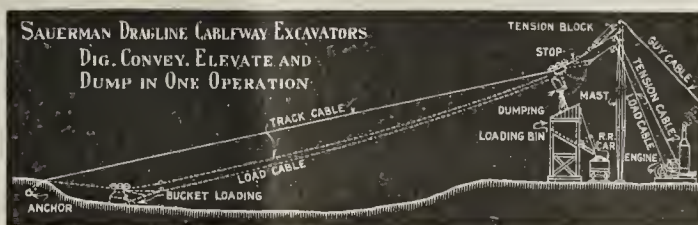
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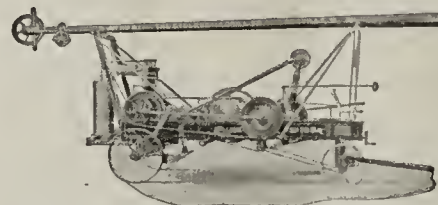
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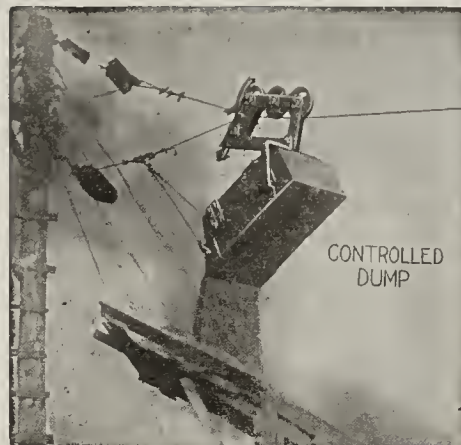
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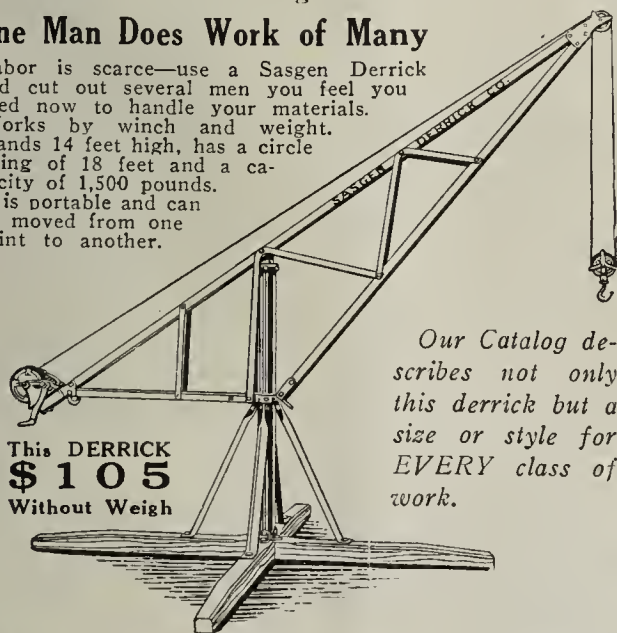
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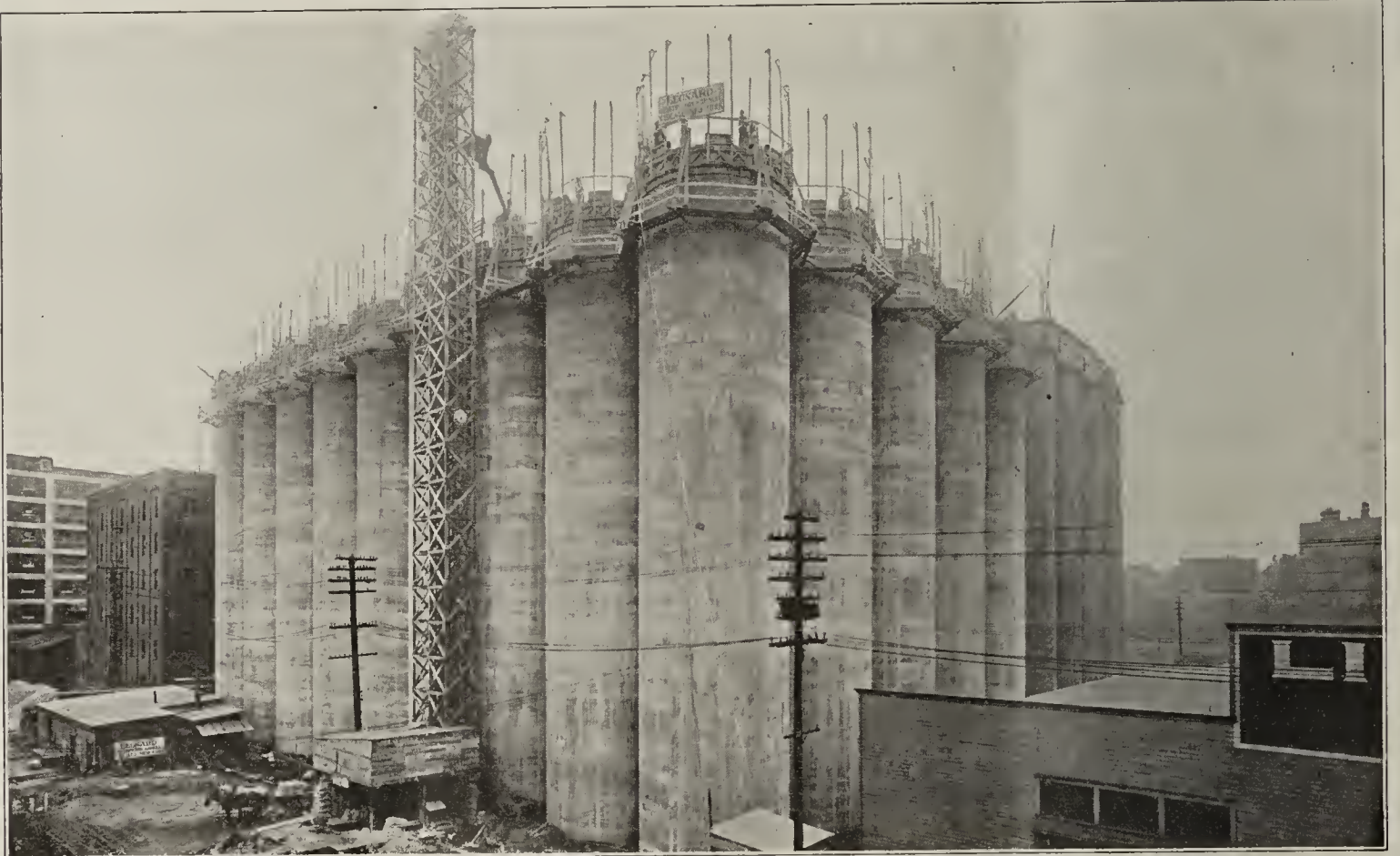
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FOR WATER PROOFING AND TO FACILITATE POURING CONCRETE



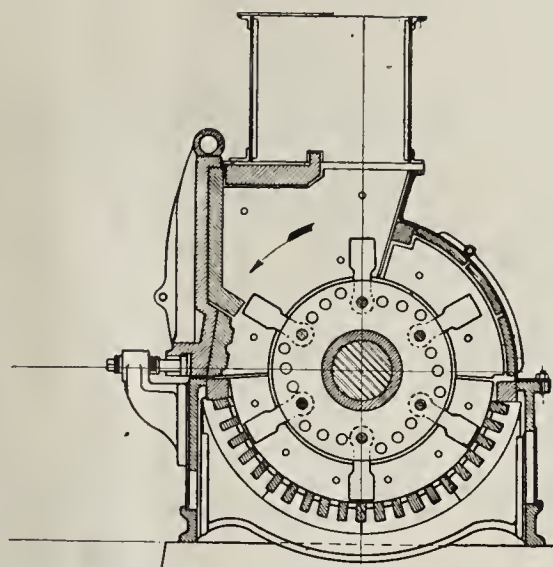
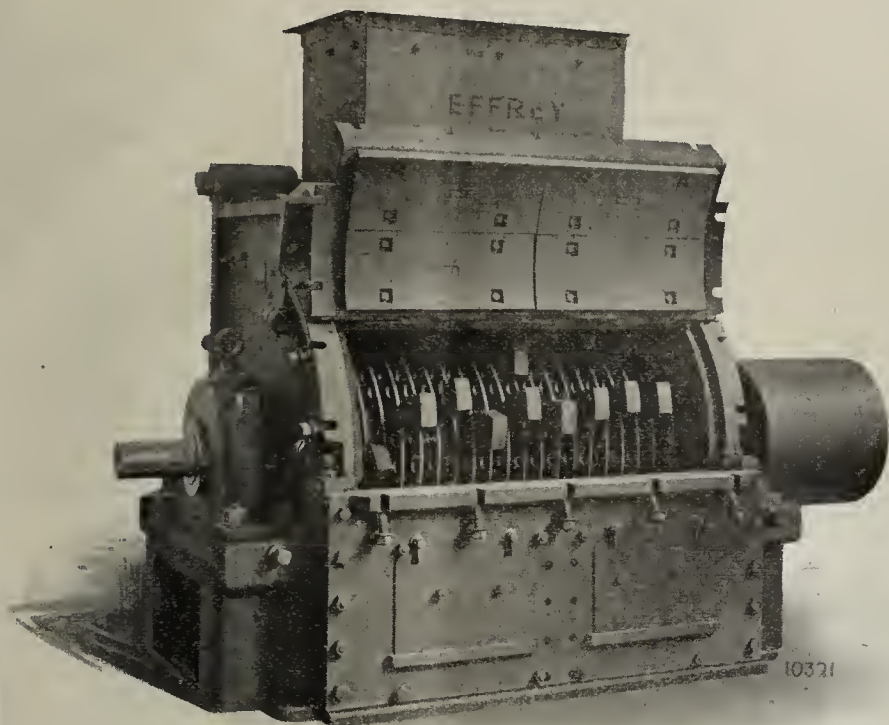
In these 51 concrete storage tanks, recently erected in Cedar Rapids, Iowa, by the Quaker Oats Co., there are approximately 12,500 cubic yards of concrete—1-2-4 mix. The walls are perfect cylinders, with no lips or bulged surfaces.

Hydrated lime was used for waterproofing and also to facilitate pouring the concrete and lifting the forms, owing to its lubricating properties. In mixing, 25 pounds of hydrated lime was put into each batch, which made the percentage of lime to cement a little over 8% by weight. The mixers used were of such size that three bags of cement could be used in each batch.

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Sectional View of Pulverizer showing
Top Feed

Note : Accessibility, Compactness and Ball Bearings

Jeffrey ^{TYPE} "B" Ball Bearing Swing Hammer Pulverizer

for Breakdown of Large Pieces of
Limestone, Gypsum, Shale, etc.

Leading Cement Mills, Lime Plants, Quarries, Gypsum Plants, etc., are being equipped with Jeffrey Swing Hammer Pulverizers to meet the constantly increasing demands.

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CEMENT AND ENGINEERING NEWS

with which Gravel & Stone Magazine is incorporated

22 Quincy Street, Chicago.

(PUBLISHED MONTHLY)

William Seafert, *Publisher and Editor*

J. F. Waldron, *Advertising Manager*

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Entered at the Post Office at Chicago, as second-class matter, July 21, 1896
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SUBSCRIPTION RATES:

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Advertising copy or changes in ads. must be in this office by the 25th of each month, as hereafter our magazine will appear on the 5th of the following month

Advertising Rates Sent on Application

Vol. 31 CHICAGO, December, 1919 No. 12

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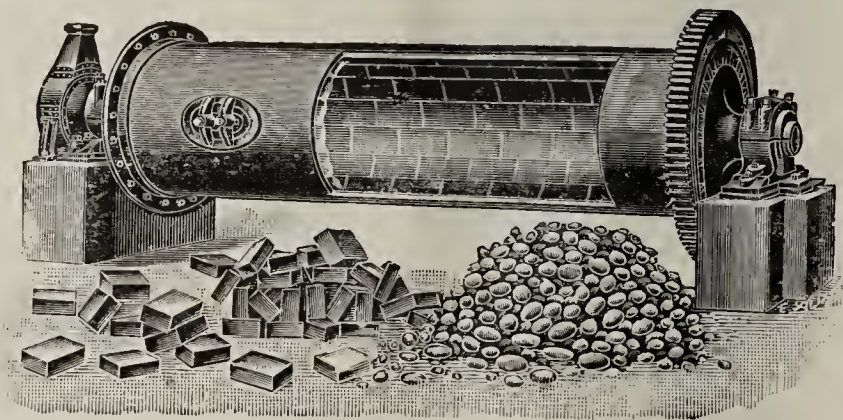
First Class Silex Slabs

for lining of tube-mills for grinding of Cement, Clinker, Kaolin, Phosphate, Limestone, Quartz, Trap, Coal, Ores, Gypsum, Feldspar, Sand, etc.

Have successfully passed some of the most severe tests. Long life and moderate price. Immediate shipment on stock sizes. Write for prices.

Societe Generale Meuliere

La-Ferte-sous-Jouarre (S-&M)
(France)



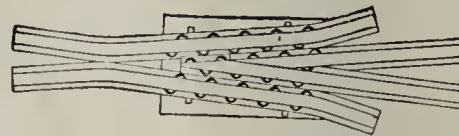
FOOTE SPEED TRANSFORMERS

Write to us, state the conditions that exist in your plant, and get the advice of our engineering department.

FOOTE BROS. GEAR & MACHINE CO.,
228-238 N. Curtis St. Chicago, Ill.

The "CINCINNATI" FROG AND SWITCH COMPANY

Established 1906
CINCINNATI, OHIO

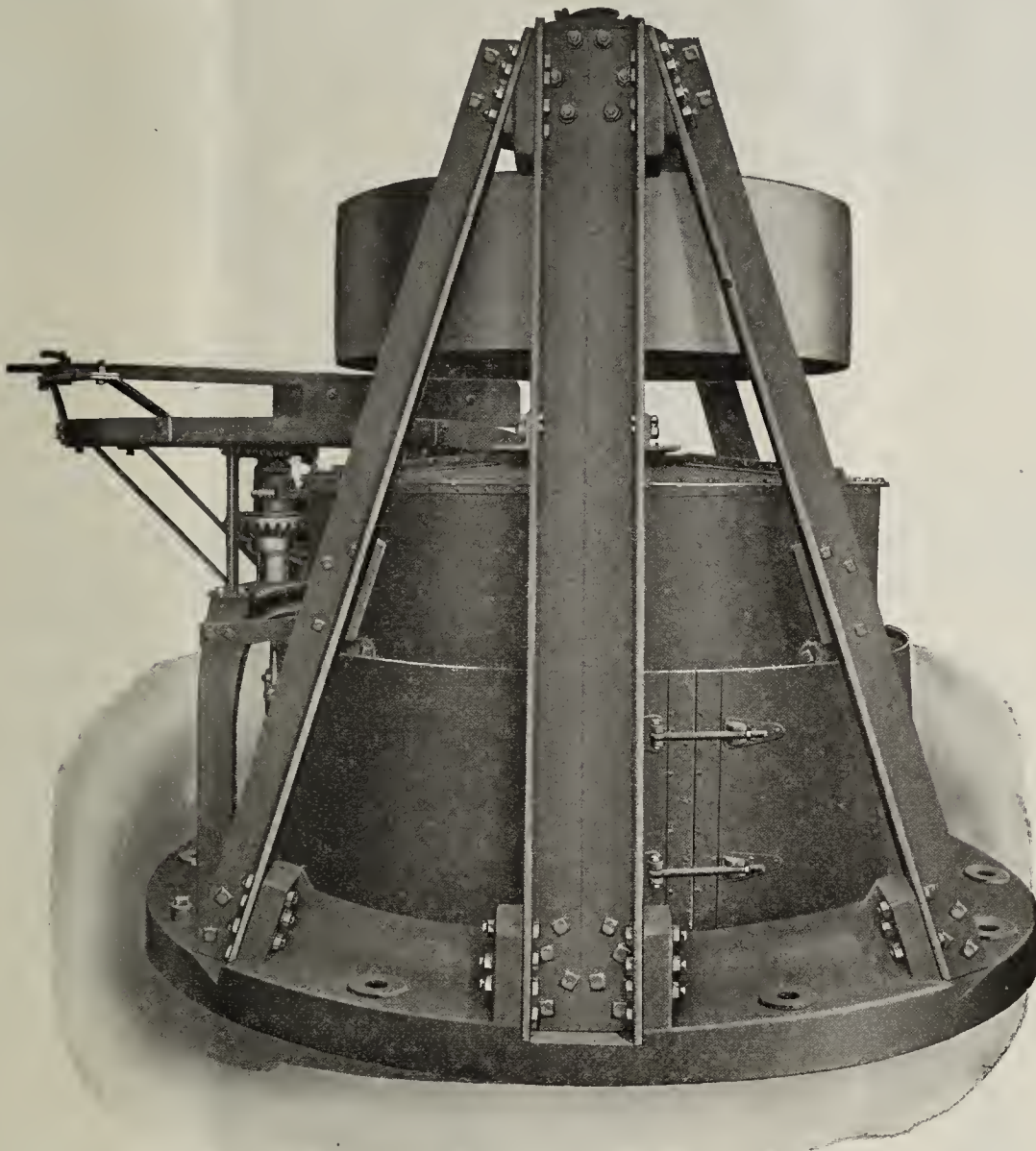


Portable and Industrial Track

Frogs Switches Crossings
Switch Stands Rail Braces

The Bradley Hercules Mill

In October, another large Pennsylvania cement company adopted this mill as a preliminary pulverizer of clinker. Watch next issue for November announcement.



Investigation means purchasing, as no other mill has ever equalled this mill's performance as to low horsepower consumption, low maintenance cost, and large output with an extremely fine product that increases the output of any tube mill.

It's a Great Labor and Money Saver

Let us send our engineer to show how these mills will fit in with your present tube mill installation and reduce your cost of manufacture and relieve your labor situation.

Bradley Pulverizer Company

Boston, Mass.

Works: Allentown, Pa.

Manufacturers of the Giant Griffin Mill



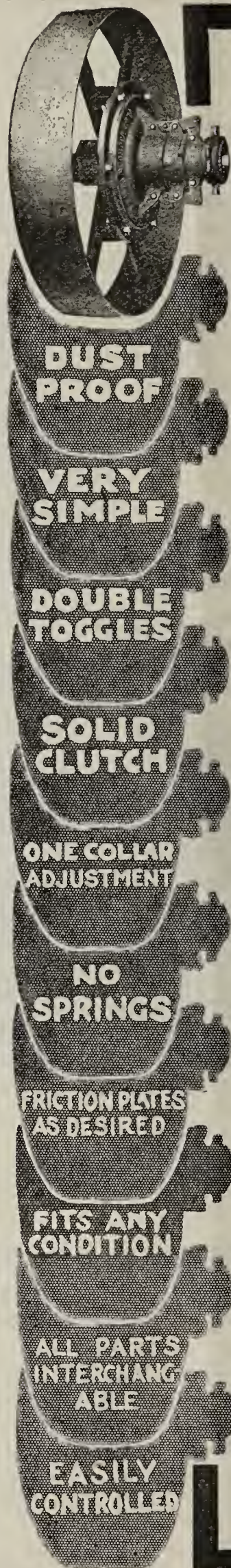
*After the
storm—the rainbow.
After the usual run of transmis-
sion troubles and belting experi-
ments—Rainbow Friction Surface
Belting.*

The Engineer will tell you why.

**“The Right Belting
the Right Place”**



United States Rubber Company



NO OTHER CLUTCH HAS ALL THESE ADVANTAGES

Plamondon Disc Type Friction Clutches have every known feature that makes toward efficiency, economy and durability in clutches. For the most economical transmission and distribution of power and easy control of the same, there can be no logical choice but that of the

PLAMONDON DISC TYPE CLUTCH

Plamondon Clutches defy the most adverse conditions. Their absolutely dustproof construction renders them particularly suitable for use in cement mills, etc.

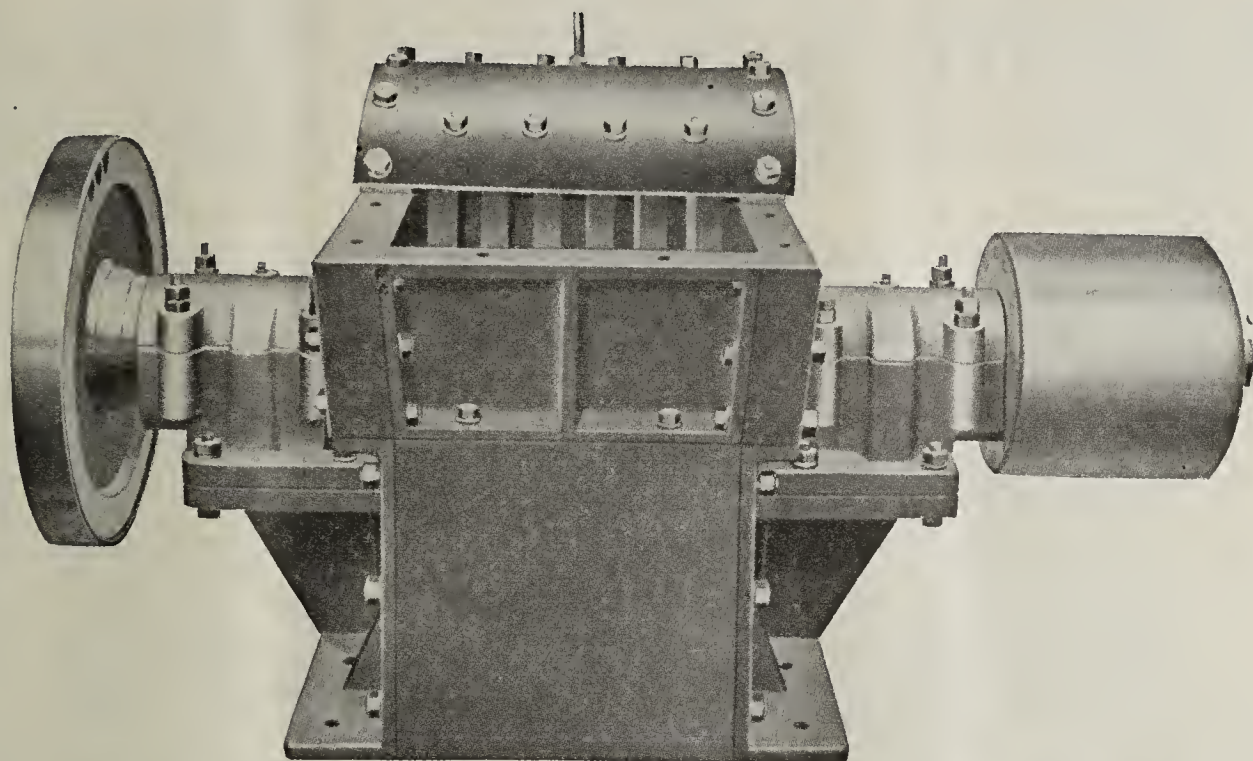
We have a 57 years' service record for this clutch.

Write for our new
catalog No. 59

**A. PLAMONDON
MFG. CO.**

12 to 24 N. Clinton Street
CHICAGO, ILL.

We manufacture Spur Gears, Bevel Gears, Miter Gears, Spur Mortise Gears, Bevel Mortise Gears, Miter Mortise Gears.



GRUENDLER

Swing Hammer Pulverizer

For economical reduction of Gypsum, Marl, Clay, Shale, Tube Mill Feed, Limestone, etc., the GRUENDLER has demonstrated in plants everywhere that it delivers every expected service, is economical in operation, dependable and free from trouble. It gives complete satisfaction and assures a superior product.

Because of correct design, good materials and superior construction—with extra strength, simplicity and the correct principles upon which it is based—the GRUENDLER affords greatest capacity with lowest horse-power requirement and minimum maintenance expense. It is built in various sizes to meet every need.

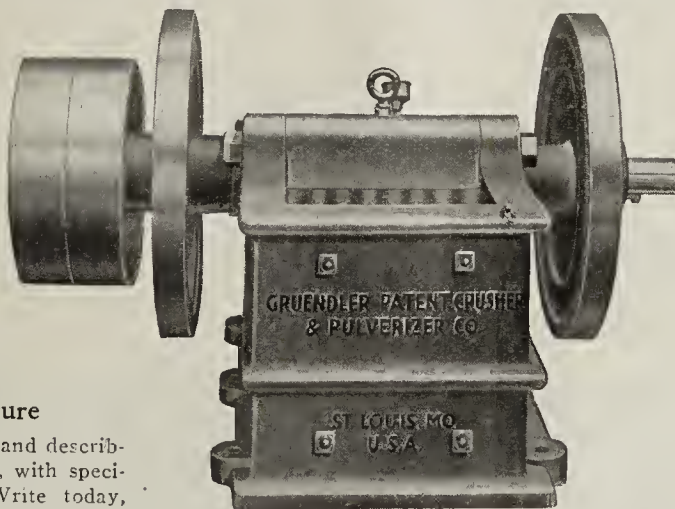
Gruendler Swing Hammer type Pulverizer is supplied with either motor-drive or belt-drive, as desired.

Gruendler Crusher Heavy Duty Jaw Type

For products requiring a jaw-crusher, the GRUENDLER will be found adequate to meet every test and demand for efficiency, dependability, durability and freedom from breakdowns. All parts are accessible for renewal or adjustment, while the power requirement is less than for any other crusher of equal rated capacity.

Write for Illustrated Literature

Let us send you our bulletins, illustrating and describing GRUENDLER GRINDERS in detail, with specifications, prices and full particulars. Write today, giving some information as to probable requirements.



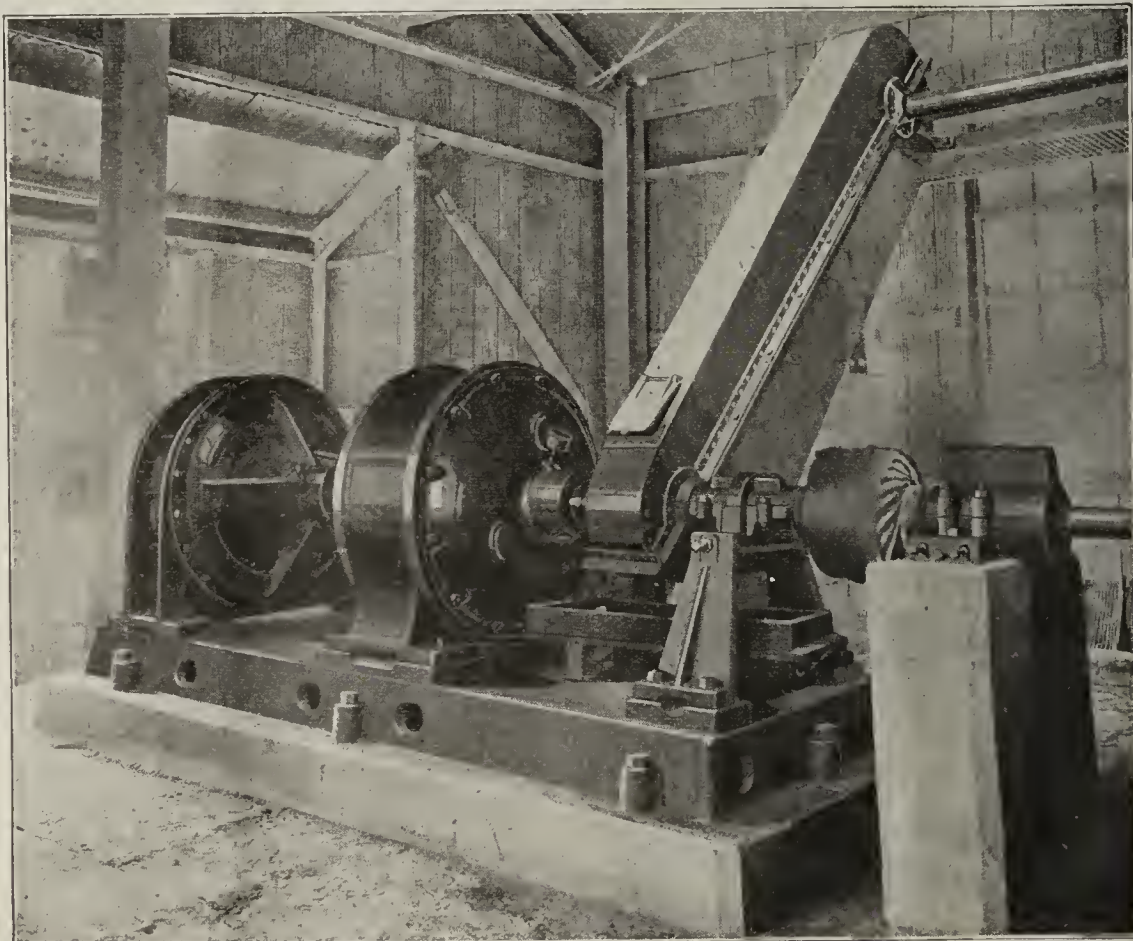
Gruendler Patent Crusher & Pulverizer Co.

991 Main St., St. Louis, Mo.

CEMENT MILLS

PRESENT UNUSUALLY DIFFICULT CONDITIONS
YET

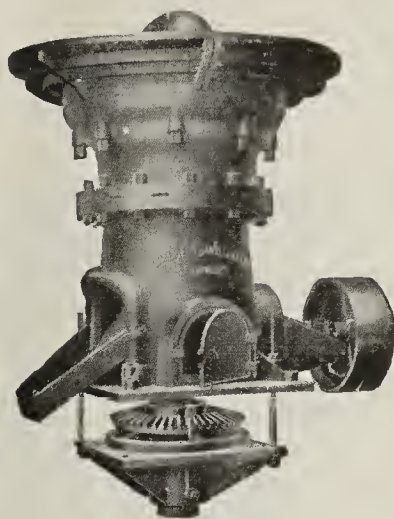
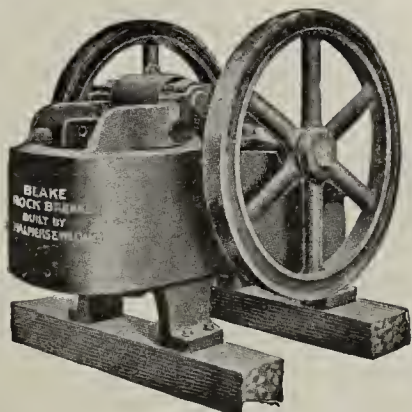
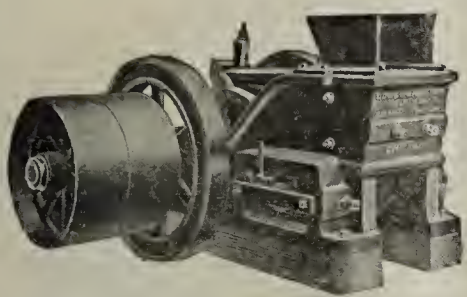
JONES SPEED REDUCERS



CONTINUE TO GIVE UNINTERRUPTED, SATISFACTORY SERVICE
MONTH AFTER MONTH AND YEAR AFTER YEAR
THIS IS THE REASON WHY
THE LARGEST CEMENT, STEEL, COAL & CHEMICAL INDUSTRIES
Place so Many Repeat Orders for Jones Spur Gear Speed Reducers

W.A. JONES
FOUNDRY & MACHINE CO.

4406 W. Roosevelt Road, CHICAGO—NEW YORK, 30 Church St.
GEARS, CAST IRON PULLEYS, LEMLEY FRICTION CLUTCHES, COUPLINGS, PILLOW BLOCKS,
HANGERS and GENERAL POWER TRANSMISSION MACHINERY



**For Quarry or Pit
Gypsum Mills
Cement Plants
Plaster Mills
Phosphate Mines**

**We manufacture mills for coarse
or fine crushing, consisting of**

Jaw Crushers—Dodge or Blake Type

Gyratory Crushers

Ball Mills

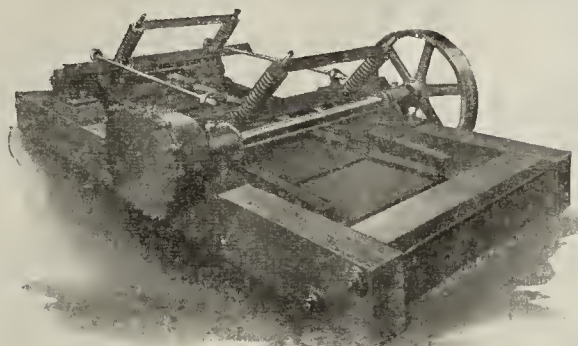
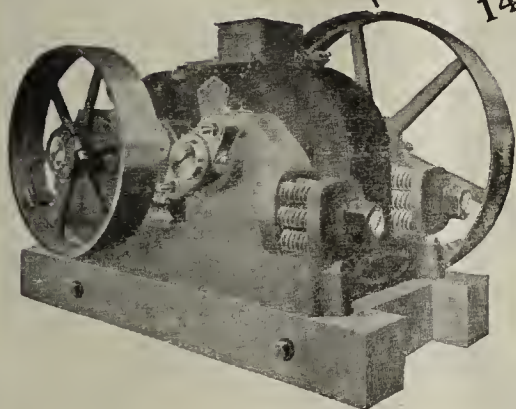
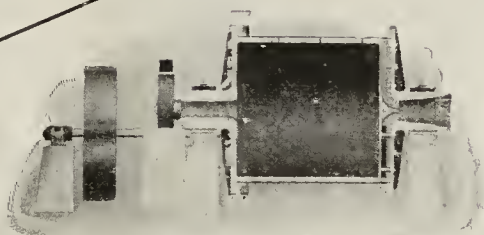
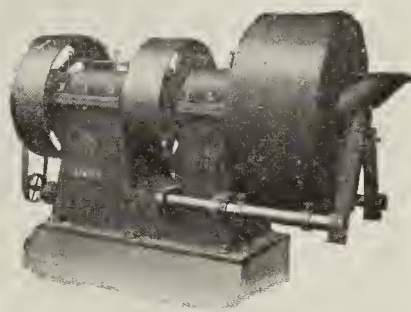
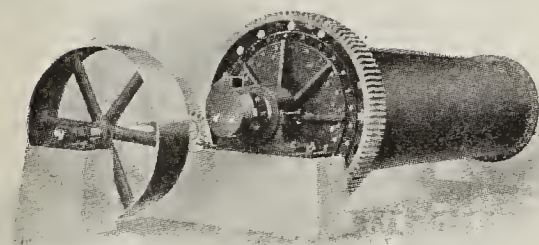
Tube Mills

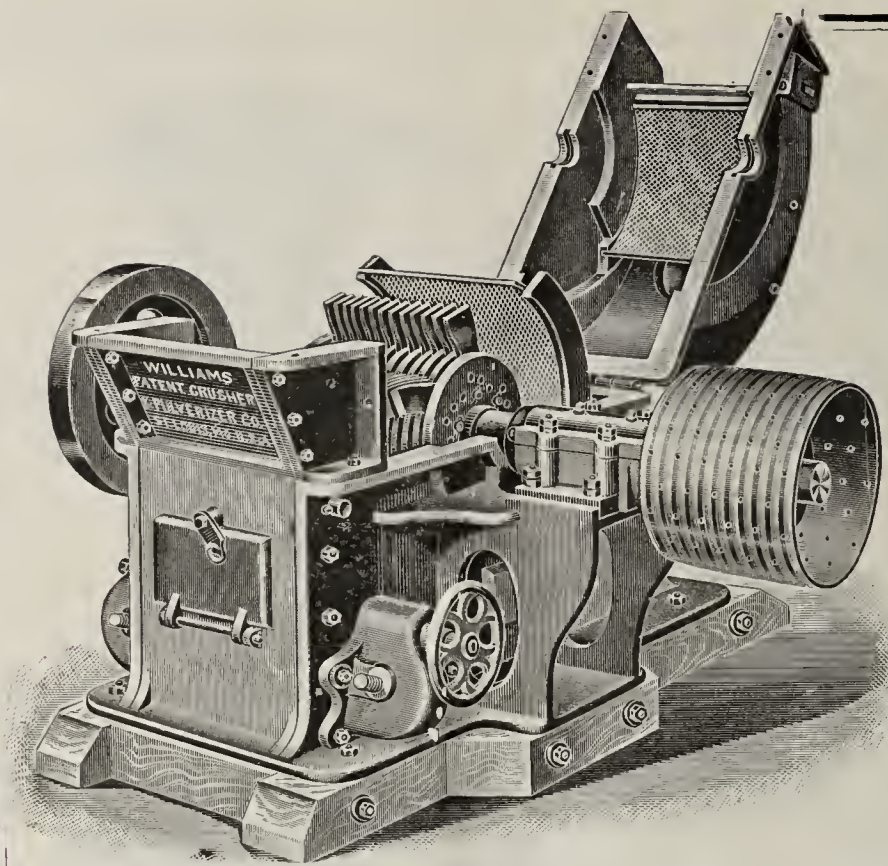
Crushing Rolls

Symons Disc Crushers

Symons Pulsating Screens

Chalmers & Williams
1445 Arnold St. Chicago Heights, Ill.





WILLIAMS LIMESTONE GRINDERS

Take 2 in. to 3 in. dry stone and in one operation, without outside screens or separators will produce 95% through 20-mesh material.

**CAPACITIES RANGE FROM
1/4 TO 30 TONS PER HOUR**

**Over 5,000 Williams Mills in Daily
Operation.**

There is undoubtedly room in your plant for one of these machines, which, in the last twenty-two years have proven that they are money savers, can be depended on, and really have merit. If further information is desired, Write for Bulletin No. 17, which is brim full.

THE WILLIAMS PATENT CRUSHER & PULVERIZER COMPANY

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Plant
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SAN FRANCISCO

FOR TOUGH ROCK



and the very heaviest, hardest work necessary to be accomplished by a crusher, there is one powerful crusher to which the "wise" man always turns. If you will ask for our Bulletin on Crushers, you'll get some information that may be worth money to you.

Sales Offices in Principal Cities

ALLIS-CHALMERS MANUFACTURING COMPANY
Milwaukee, Wis.

Our Name is Your Assurance.

ALLIS-CHALMERS



Westinghouse Motor Drive For Cement Plants

The progressiveness of the Electrical Engineer in constantly improving apparatus and the methods of applying it has been responsible, to a large extent, for the reliable and increasing service rendered industries by electricity.

Westinghouse Engineers are constantly studying conditions of various plants. Guess work is eliminated and desired results are secured.

The illustration shows 150 hp. Westinghouse type "CS" Motors driving Kominuters at the Oregon Portland Cement Company, Oswego, Oregon.

WESTINGHOUSE ELECTRIC AND
MANUFACTURING COMPANY
East Pittsburgh, Pa.

Sales Offices in All Large American Cities.

465



10 IN. HY-RIB (SEVEN-RIB). Ribs $\frac{1}{8}$ in. high, 4 in. apart; sheets 24 in. wide.

Insure Your Building Results

by using the complete line of material for use in all types of construction. Be sure of prompt delivery, as our complete stocks and large organization warrant immediate shipment.

HY-RIB and RIB LATH

the acknowledged standard material, as used everywhere in all kinds of construction work.

The many depths, gauges and types of Hy-Rib adapt it to reinforcement of concrete floors and roofs. It is an ideal plastering surface for walls and ceilings and renders the building entirely fireproof. Easily put in place and on arched and curved work it is furnished bent to the exact curve.

Our complete line includes, in addition to the above, Diamond Lath in two types; Pressed Steel Channels and Studs of all varieties; four types of Corner Beads; three types of Base Screeds, etc. Send for free Hy-Rib Hand Book.

TRUSCON STEEL COMPANY, Youngstown, Ohio

Representatives in Principal Cities

For Concrete Roads

Kahn Road Mesh
The most efficient reinforcement for concrete roads and pavements.

Kahn Curb Bars
Protect and reinforce concrete curbs.

Kahn Armor Plates
Perfectly protect expansion joints.

Write for Highway Pamphlet and estimates.

DU PONT AMERICAN INDUSTRIES

Nine Good Reasons for Electrical Blasting

- 1—With an electric blasting machine you can fire from one to one hundred and fifty charges simultaneously.
- 2—Electrical blasting allows better tamping and fullest confinement of the gases.
- 3—Fuller development of the explosive force with consequent greater shattering.
- 4—Less smoke and fumes and quicker return to the working face.
- 5—Better results with smaller quantity of explosive, therefore cheaper.
- 6—With the Rheostat and Galvanometer the electric connections can be tested to assure detonation and to avoid misfires.
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- 8—There is no need of matches, torches or open flame detonation of explosives where electrical blasting is practiced.
- 9—The dependability of Du Pont electrical blasting equipment, that leaves nothing to chance, but gives the operator control of the entire blasting performance. Du Pont blasting accessories are correct in design and efficient in service. They are the result of practical experience and scientific research—the last word in modern, sure-fire blasting equipment.

A free copy of our "Blasting Supplies Catalog" will prove helpful. Write for it today to Advertising Division,

E. I. du Pont de Nemours & Co.

Wilmington

Delaware

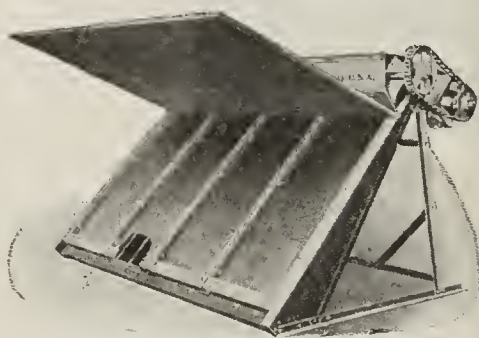
Visit Du Pont Products Store When in Atlantic City.



DU PONT

National Screen Separator

THE LEADING SCREEN IN



**Efficiency
Durability
Simplicity**

Write for Descriptive Literature to

National Engineering Co.
549 W. Washington Blvd.
Chicago, Ill.

"HERCULES SOLID WELD" STEAM SHOVEL CHAIN



The Chain that puts the SHOVE
in Steam SHOVELS

MADE ONLY BY

THE COLUMBUS McKINNON CHAIN CO.

General Offices:

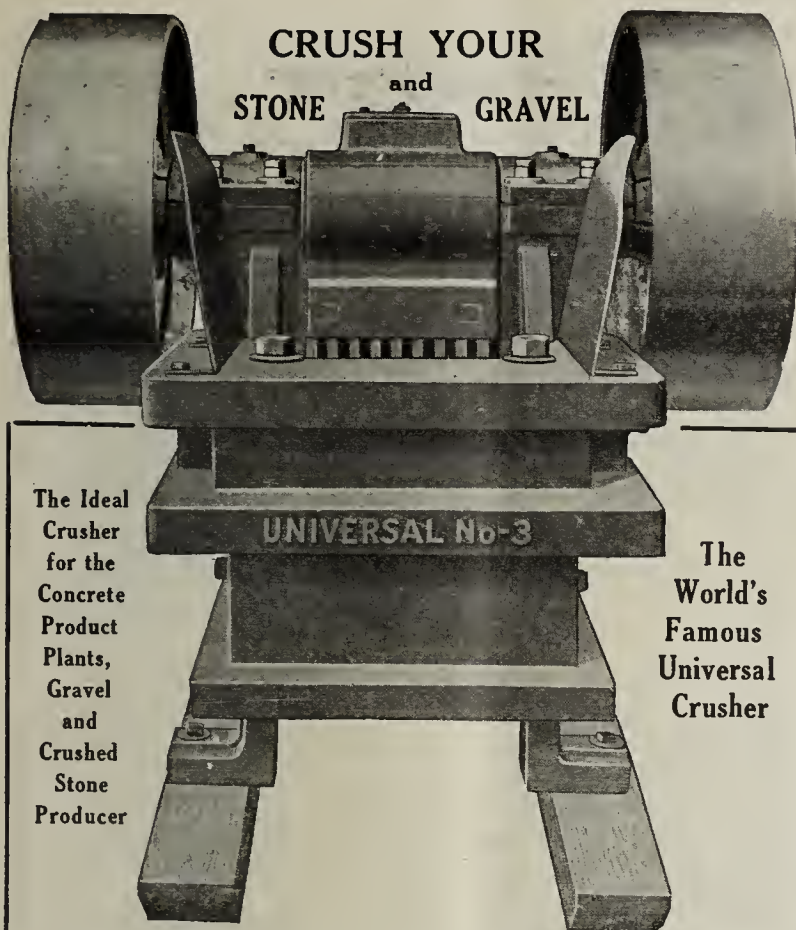
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SAND PUMPS OF ALL TYPES

The Kingsford Sand and Dredging Pumps are built in all sizes for Engine, motor or belt drive and can be furnished with or without linings.

Our single stage Centrifugal and Multi-stage Turbine Pumps are guaranteed the most efficient made.

**KINGSFORD FOUNDRY &
MACHINE WORKS**
OSWEGO, N. Y.



The Ideal
Crusher
for the
Concrete
Product
Plants,
Gravel
and
Crushed
Stone
Producer

The
World's
Famous
Universal
Crusher

**We Build Crushers from 5 Tons to 300 Tons
per 10-hour Capacity**

Instantly adjusted to produce size required from
 $\frac{1}{4}$ inch to 3 inches Write for Folder No. 14.

UNIVERSAL CRUSHER COMPANY

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The Season's Greetings

Again comes Christmas—
That season of
Good Cheer,
And kind reminder
Of the many favors
And friendly co-operation
That you—
Our customers and friends
Around the world—
Have evidenced
Toward us
Throughout the year.

So now
We Traylor people—
From Apprentice Lad
To Manager—
From Office Boy
To Chairman—
All Join
In expressing
Our deep appreciation,
And in wishing you,
One and all,
A Merry Christmas,
And a Happy
And Most Prosperous
New Year.

**Traylor Engineering &
Manufacturing Company**

Allentown, Pa.

New York Pittsburgh
Chicago Los Angeles Spokane

CUT Gears

Spur,
Spiral,
Bevel and Worm
Steel and Rawhide

Accuracy and Prompt Delivery

When you want a gear cut you want it quickly,—we emphasize our promptness without sacrificing accuracy.

Ganschow Cut Gears

stand first in accuracy—perfect mesh—silent operation and the quality that counts for long service.

*Estimates furnished from drawings and specifications.
WRITE FOR CATALOG.*

WILLIAM GANSCHOW CO.
1003 W. Washington St. CHICAGO



**Railroad Grading
Drainage Ditches
Irrigation Canals
Levee Building
Embankments
Wagon Loading
Highway Grading**

The History of Railroad and earth construction work for the past 35 years has been the story of THE NEW ERA ELEVATING GRADER.

Old Experienced Contractors still "in the game," as well as many who have "passed along," learned years ago to look upon the "New Era" as the most essential piece of equipment on a successful grading job.

PRESENT DAY road builders have recognized the advantages of the "New Era" in solving their grading difficulties. It is good for both grading and excavating the road bed; in the latter case getting the material out of the grade to the wagon or ditch in one movement is a worth-while labor-saving achievement.

Austin Dump Wagons

are popular with contractors because they are

- Easy to load (being low)
- Easy on teams (having short wheel base)
- Easy to dump (hingeless doors clear the material)

Austin Manufacturing Company
CHICAGO

New York

San Francisco



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Rotary Kilns can be used for burning lime and limestone that crumbles and breaks up under heat. Rock of this character could not be burned in vertical kilns, because the draft would be stopped when the limestone disintegrated.

Rotary Kilns have the added advantage over stationary types of a low labor cost for operating, a uniform burning, and a high fuel efficiency.

VULCAN Rotary Kilns are designed to operate satisfactorily for years at the lowest maintenance cost.

Correspondence Invited

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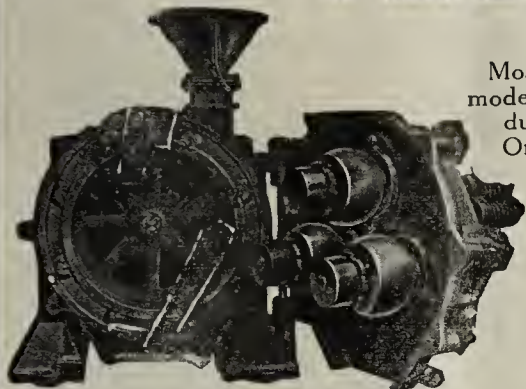
*Designers and Builders of
Rotary Kilns for 25 years*

1740 Main Street, Wilkes-Barre, Pa.

VULCAN ROTARY KILNS

STURTEVANT MILL CO.

HARRISON SQUARE - - BOSTON, MASS.



Ring-Roll Pulverizer

RING-ROLL PULVERIZERS

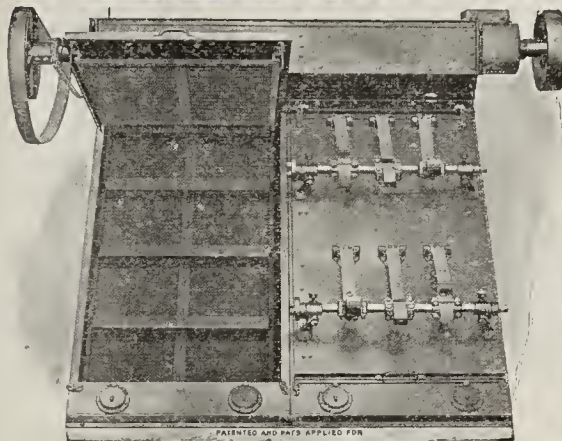
Most durable and efficient grinder for hard and moderately hard rock or ore. Used for the reduction of Cement-Clinker, Limestone, Quartz, Ores, Granite, Trap, Phosphate, Coal, etc., etc. Hundreds in use.

Send for Circular 79

NEWAYGO SUPER-SCREENS

Inclined Vibrating Screen, Unit Construction. Screens everything screerable that is reasonably dry. Produces from $\frac{1}{4}$ mesh to 180 mesh.

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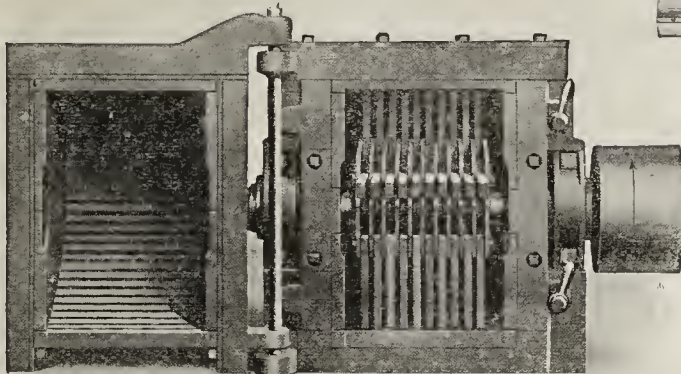


Newaygo Super-Screen

SWING-SLEDGE MILLS

The greatest producers known on Limestone, Lime, Shells, Chemicals, Talc, Clay, Chalk, Bark, Rosin, Sulphur, Coal, Salt, and many other moderately hard and soft materials. High Speed Pulverizers, crushing by a series of blows delivered at high speed against the material fed into the machine.

Send for Circular 84



Swing-Sledge Mill

WE MAKE THE
LARGEST COMPLETE
LINE OF
CRUSHING, GRINDING,
SCREENING, WEIGHING,
SACKING, ELEVATING
AND MIXING MACHINERY
IN THE WORLD

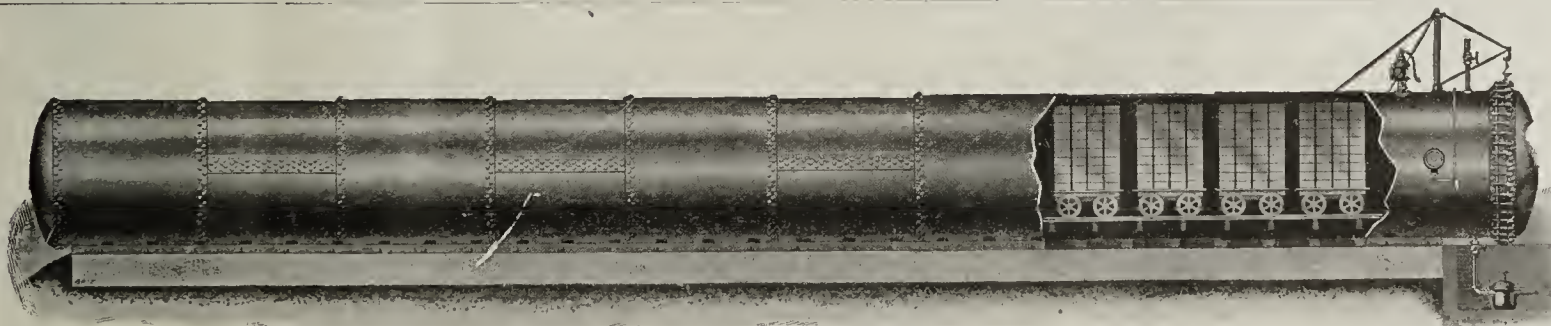
Send for Condensed Circular No. 60

Sand Lime Brick Machinery

Our complete line of Sand Lime Brick Machinery makes it possible to secure just that machinery which is required to make your plant a success. We favor no particular type of machinery but are guided by the needs of the customer. Our wet and dry grinding mills have transformed a number of unsuccessful plants into dividend producers, while our Presses, Mixers, Hardening Cylinders and other equipment are of equal quality. We can exactly meet the demands of any manufacturer with a quality of machinery which will operate at a profit with a minimum amount of attention and expense.

Correspondence solicited

The American Clay Machinery Co.
WILLOUGHBY, OHIO



Blasting Supplies

that are dependable



Blasting Caps
 Blasting Machines
 U. S. Standard
 Little Giant
 Mason Turbine
 Cap Crimpers
 Delay Action Exploders
 Delay Electric Blasting Caps
 Delay Electric Igniters
 Electric Blasting Caps
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 Safety Fuse
 Tamping Bags
 Thawing Kettles
 Portable Magazines
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 Cordeau Bickford
 Blasting Paper
 Kapseal

In all work calling for the use of explosives, it is extremely important that the accessories known as Blasting Supplies shall be of the very highest quality. Defective or weak detonating devices often imperil both life and property—and result in a loss of explosive energy, if no more.

In the manufacture of Atlas Blasting Supplies the most scrupulous care is exercised to make them thoroughly practical, effective and **RELIABLE**. The **ATLAS** name on detonators, galvanometers, rheostats, blasting machines and other blasting supplies signifies that they are as safe and sure as it is possible for experience and manufacturing skill to make them.

Our Service Division will gladly confer with you as to what detonating supplies will give you the most economical service.

ATLAS POWDER COMPANY

140 North Broad Street, Philadelphia

Branch Offices: Allentown, Pa.; Birmingham, Ala.; Boston; Chicago; Des Moines, Ia.; Houghton, Mich.; Joplin, Mo.; Kansas City; Knoxville; McAlester, Okla.; Memphis; Nashville; New Orleans; New York; Philadelphia; Pittsburg, Kans.; Pittsburgh, Pa.; Pottsville, Pa.; St. Louis; Wilkes-Barre.

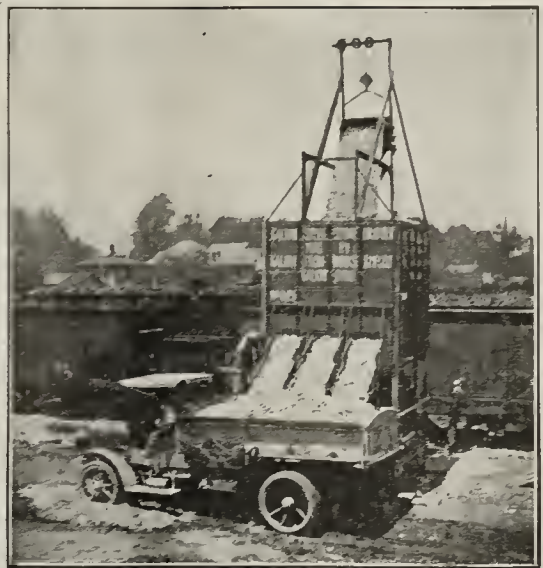


One man and a **GALION CAR UNLOADER**

can easily unload your gravel, sand, coke, slag, coal, etc., from railway cars into wagons, trucks or trailers at a cost of 3c per ton.

Perhaps you think he wouldn't be able to unload the material with much speed, but if 400 to 500 tons per day is your idea of speed, then he will come up to your requirements.

The Saving Is Big in Time, Labor and Money



The

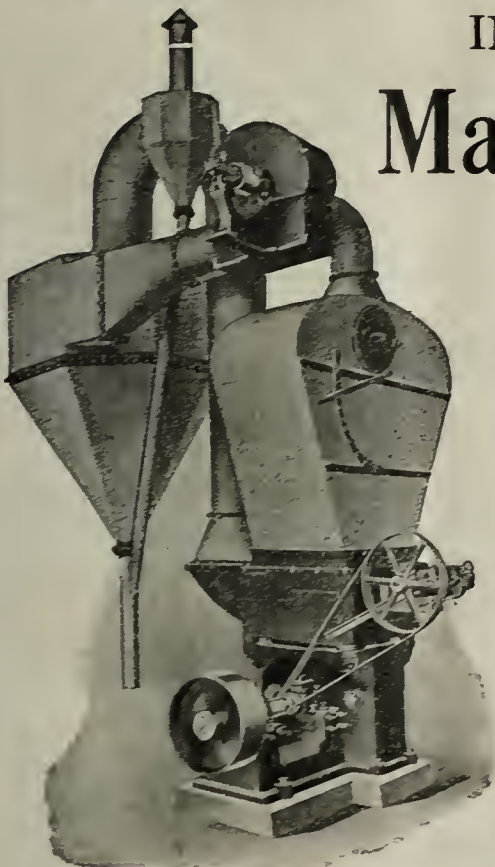
Galion Gravel Screening Plant

provides the finest kind of road material from nearby gravel pits. Screens, grades and loads gravel at a total cost of 20c to 35c per yard.

*Write for complete information and prices
Address Dept. RM5*

The Galion Iron Works & Mfg. Co.
Galion, Ohio

Complete Grinding IN ONE Machine



In successful use
grinding
Cement, Clinker,
Limestone, Coal

INSTANT
REGULATION
OF
FINENESS

NO DUST

Send for Circular

THE BONNOT CO.
CANTON, OHIO

*Put Your Excavating and Unloading
Problems up to a*

BYERS AUTO-CRANE

Ask for BULLETIN 1015 Showing a Variety of Uses



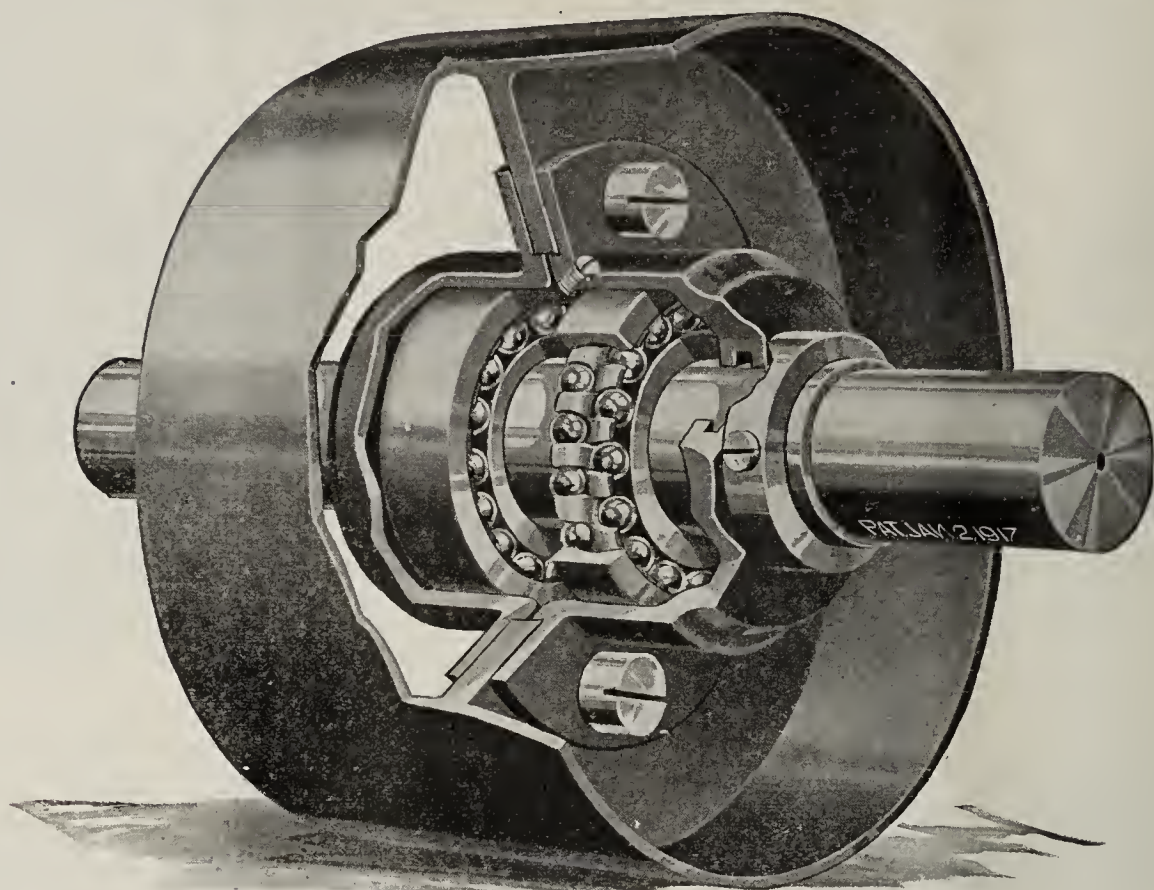
Steam, Gasoline or Electric Power
Road Wheels, Rail Trucks or Caterpillars

The John F. Byers Machine Co.

204 Sycamore St.

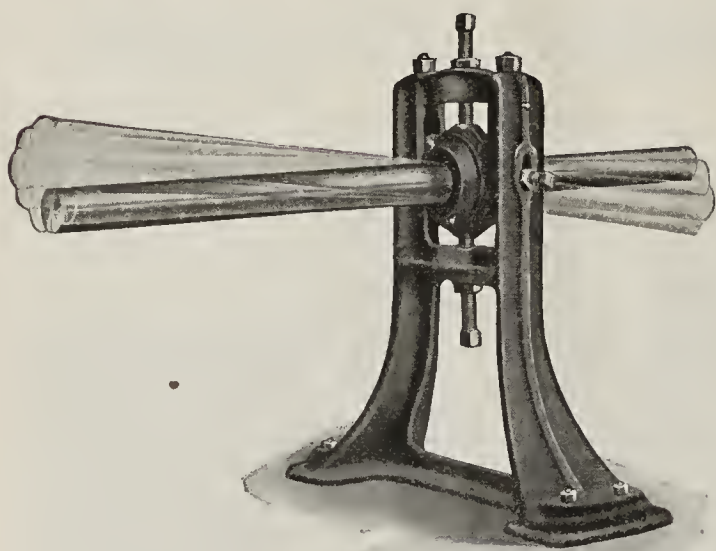
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ONE OF MANY SPECIALTIES IN

A Complete Line of Power Transmitting Appliances SKF Ball Bearing Loose Pulleys



A Loose Pulley Guaranteed to Carry Any Belt Load at Any Speed Without Bearing Troubles.

Suitable for Machines, Mules, Counters, Idlers and Friction Clutches. Simple to Install. No Dripping of Oil. Noiseless, Dustproof. Loose Pulley Troubles Eliminated.

Investigate Our Line Shafting Equipment

Savings of thousands of dollars are being effected in plants by use of S-K-F Frictionless, Self Aligning Ball Bearing Hangers. They are correctly designed for maximum strength and conserve power that is otherwise wasted.

We Carry in Stock Wood and Steel Pulleys, Ball and Roller Bearing Drop Hangers, Ball and Roller Bearing Post Hangers, Ball and Roller Bearing Pillow Blocks, Collars, Couplings, Oneida Steel Pulleys, Elevator Buckets, Etc. Write for Prices and Catalog E.

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Wisconsin

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Cement and Engineering News

Vol. 31

Chicago, December, 1919

No. 12

Wail of Winter

I used to be a cracker-jack at stopping all the work
That enterprising business men were not inclined to shirk;
They hated like the dickens to dismiss their gangs and quit,
Because they know that such a plan their pocketbooks would hit.

My winds are just as keen and blue as ever in the past,
But my reputation's going and it's going mighty fast.
No matter how I howl and snow, no matter what I do,
I cannot halt proceedings of the gallant concrete crew.

They found a way around me and they're giving me the laugh,
For Business-Killer Winter they've inscribed an epitaph;
My requiem is daily sung, but not a tear is shed,
The concrete gang rejoices o'er the tombstone at my head.

Precaution tied a can to me and made of me a "nut";
December work now pushes on as when the hay is cut.
I tried to freeze Precaution and to put his men to rout,
But "Pre" was pretty previous and completely shut me out.

Precaution has an ally and his name is Old King Heat;
They pull together nobly in the house or on the street.
The music of the mixer mingles with the dollar's ring,
And work will still be whooping when I slip away in spring.

Editorial

The Battle for "Open Shop" in Seattle and Its Results

By F. R. Singleton

Seattle is breaking the domination over her industries of the radical element of organized labor which has held almost absolute sway in that city for the past three years, and has so restricted production and increased production costs that her ship yards, lumber mills, and many lesser industries have been finding it hard to compete with those in which the labor situation was less acute; that she was beginning to lose commerce to other Pacific ports where the labor cost of handling cargoes was less; that she was losing new industries seeking location on the Coast, which avoided Seattle because of industrial conditions.

Seeing her opportunity of becoming the greatest city on the Pacific Coast and one of the great ports of the world slipping away from her, Seattle has risen in the might of an American city, and is breaking the tightening bonds which were beginning to strangle her industries and commerce. Seattle is rapidly going "open shop." Seattle has declared her independence of organized labor rule and is refusing even to deal with the radicals in control of organized labor in the city, whose course since the signing of the Armistice has proven them to be no better in their actions, sentiments and purposes than the I. W. W.

They do not call it "open shop" in Seattle. They call it the "American Plan of Employment" which, as defined by the "Associated Industries of Seattle," the organization leading the movement to success, means that every man shall be protected in his inalienable right to work, regardless of political, religious or labor affiliations; that every employer shall be protected in his right to run his own business and to hire employes without having to gain the permission of an autocrat of labor.

The open shop is being established in Seattle by the breaking of a series of strikes, designed by the radicals in the labor movement as a substitute for the general strike, by which they planned to bring about the paralysis of industry in Seattle and so discourage employers that they would be able to take over industry themselves under a soviet system. The open shop is being established by the force of public opinion as the result of an intensive publicity campaign in the Seattle dailies, conducted by the Associated Industries. Pages on pages of advertising informed the Seattle public that the industries and commerce of Seattle were being attacked by the radicals of organized labor and that, if their domination over organized labor and the industries and commerce of Seattle were not broken, the population, industry, commerce and prosperity of the city would decline.

The response was prompt. The Chamber of Commerce, the Rotary Club, the Kiwanis Club and all other civic and commercial organizations of the city took action demanding the end of radicalism and sabotage in Seattle, and endorsing the open shop in industry. These declarations were published in page advertisements, and at the end of ten days of this intensive advertising, the public sentiment in Seattle was overwhelmingly in favor of Americanism in industry, and the power of the radicals was broken. Where, a year ago, the closed shop was strongly supported by public opinion in Seattle, today the public is demanding open

shop, and any employer who signs a closed shop agreement with any labor union will be exceedingly unpopular.

The movement in Seattle is not against unionism, but against the domination of unionism and industry by un-American radicals. The Associated Industries, in its publicity, has repeatedly recognized the right of workers, as well as employers, to organize; has endorsed the principle of collective bargaining; has declared that there shall be no discrimination against union men under the American Plan, and has urged employers not to take advantage of unemployment to cut wages. The Associated Industries has been consistently American and so has won the confidence of the public and of the conservatives of union labor.

Seattle is winning industrial independence by the power of organization. While the individual employer, with a few exceptions, in the past has been unable to withstand the radicals who ruled Seattle labor and has bowed to their dictates, the employers of Seattle collectively, banded together along with many other citizens in the Associated Industries, have been able to defy the radicals and to establish open shop in every Seattle industry in which a strike has occurred or a contract broken by the unions, during the past three months. In rapid succession, the building industry, the job printing industry, the merchant tailors, the dyers and cleaners, the jewelers, the shoe repair shops and the master pile drivers have declared and established their independence of radical domination, meaning that the unions have lost control of industries in which thousands of men and women are employed.

Seattle would progress on the open shop road much more rapidly, under the stimulus of public opinion, if it were not for the fact that the Associated Industries has taken a strong stand against the breaking of existing contracts with labor unions. One of the cardinal principles of the organization is that employers must keep faith with each other and with employes, and so the open shop movement progresses as strikes occur, unions break contracts and existing contracts expire.

The Associated Industries was formed in Seattle as a result of the general strike of last February. The revolutionary character of that attempt was recognized by the public and the necessity of cleaning the radicals out of organized labor was brought home. There was much open shop sentiment as a result of the general strike but, as a large percentage of union labor in Seattle is loyal American, the majority of employers favored giving the unions a chance to clean house of the radicals before taking any drastic steps. The Associated Industries, led by Frank Waterhouse, a leading citizen of Seattle, with large shipping and industrial interests, was organized to band all employers together in an effort to bridge the chasm between the employers and employes by giving the employes such a square deal that the revolutionary appeals of the radicals would fall upon deaf ears, and that labor would throw the I. W. W. and other radicals out of control of Seattle unions. During last spring and summer, the Associated Industries grew rapidly in membership and influence, and endeavored consistently to cultivate better relations between employers and labor, and to promote a square deal for the employe, the employer and the public in general in Seattle—but the unions failed to clean house.

The final declaration for the open shop in Seattle came when Mr. Waterhouse became convinced that the radicals, still in complete domination of the unions, were attempting, by a series of strikes, to paralyze the industries of Seattle and take them over. Advance information of this plan was verified by events. On Sept. 2, the carpenters and some of the other unions in the building trades struck to enforce impossible wage demands, in spite of the vital public need of more homes and other buildings and the willingness of the employers to arbitrate. They arrogantly stated that their demands, involving \$10 a day for carpenters and other exorbitant increases, must be granted first, and then they would talk arbitration. The job printers, the tailors, the dyers and cleaners and piledrivers followed in rapid succession and the air was full of talk of strikes in other industries.

On October 14, Seattle contractors, backed by the Associated Industries of Seattle, declared open shop in the building industry, after six weeks of fruitless negotiations with the unions to bring the strike to a settlement on terms which would not make it impossible for new buildings to be undertaken. Their action, announced in page advertisements in the daily newspapers, was applauded by the public. On October 31, the Building Trades Council voted to call the strike off. The strikers returned at their old wages and under open shop conditions.

It took only one seven-column, fifteen inch advertisement in the Seattle dailies, announcing open shop and inviting men to work under the American Plan, to establish the piledriving industry on the open shop basis. The fight has been harder with the job printers, the tailors and the dyers and cleaners, but the employers in each of these three industries declared unequivocally for the open shop and are making it stick. The employing printers have been drawing men from all over the United States to take the place of those strikers who refuse to return to work, and are gradually building their forces up to normal. The tailors have been greatly helped by the fact that all the associations of employing tailors in the cities of the Pacific Coast as far south as San Diego, California, have followed the example of Seattle and have declared open shop. The dyers and cleaners have gotten back many of their old employes and are back to normal in their operations. To have granted the demands made in many of these lines would have amounted practically to turning over the business to the employees.

The declaration of open shop by the building contractors was a body blow to union labor radicals and disarranged their plans to bring about industrial paralysis by involving one industry after another in strikes. A sentiment against strikes developed in the unions, and no more strikes were called.

Once decided for the open shop, the Associated Industries conducted an intensive publicity campaign in the three loyal daily newspapers of Seattle. In a series of ten page advertisements, beginning October 29, the Associated Industries aroused the community to the danger of radical domination and demanded that the industries of Seattle be run on the American Plan. The campaign was assisted greatly by the newspapers themselves in strong editorial and news publicity.

At the end of ten days, public sentiment was strongly in favor of the open shop.

Then came the murder of four former soldiers by the I. W. W. during the Armistice celebration parade at Centralia, Washington, a few miles from Seattle and the suppression by the government of the disloyal Union Record, the organ of the radicals, to crystallize sentiment in Seattle against the reds in control of labor. The sentiment grew so strong that the elim-

ination of the radical alone can save unionism in Seattle.

The movement for the American Plan, the open shop has spread from Seattle to the other cities of the Pacific Coast, and the Pacific Coast expects to see it sweep the country until the right of all Americans to work without being subjected to coercion and intimidation is established. San Francisco, Portland, Spokane and Tacoma have organized "Associated Industries" on the Seattle plan. The Pacific Coast is making a new declaration of independence for America.

Oregon Cement Mill, Idle Since 1916, Re-opens

The Beaver Portland Cement Company's factory, erected at Gold Hill, Oregon, in 1914 at a cost of \$650,000 and operated a short time in 1916, is being rapidly refitted by a large crew of workmen and will be ready to operate about the first of the year. Finances and rivalry of share and bondholders have caused the idleness of this large structure during the past year, while large quantities of cement has been used in Jackson and Josephine counties in building highways and bridges. In the recent refinancing of the organization in Portland, under the management of Fletcher Linn, the Portland, Willamette valley, and local share and bondholders took over all the holdings of the eastern and middle western investors. In lieu of these holdings preferred stock has been issued.

The capacity of the plant is 1,000 barrels or 4,000 sacks daily, requiring 50 men to operate and 40 men for the two quarries supplying the plant. The plant is located on the main line of the Southern Pacific railway. One of the quarries is three miles below the plant, on the railroad, while the other quarry adjoins the plant, supplying the limestone, shale and clay for the finished product. The lower quarry supplies the plant with crushed limestone and shipping limestone. The plant and quarries are operated by electric power, and crude oil is used for fuel in the burners.

Government Fires Its Parting Shot in Oregon Cement Case

The case of the government against the Oregon Portland Cement Company was summed up this morning by Barnet Goldstein, assistant United States attorney, in a two-hour argument, in which he stated the government's case was "made up out of written documents of the Oregon, Washington and California cement companies covering a period of three years, which reveal the workings of a complete combination that existed, against which the common people had no chance."

A list of the bids made to the city of Portland by Oregon, Washington and California cement concerns was read, in which the figures for all quotations made in August and December, 1915, and March, June and September, 1916, were shown to be identical on the part of all the companies, which the government alleged agreed to exact the same price, \$2.30.

Attention of the jury was called to the case of the Eastern Washington company which offered in 1915 to sell cement in Portland for \$1.65, as against Oregon quotations of \$1.90, providing the Washington concern could get action on favorable railroad rates. The prosecution alleged that the defendants and others held meetings in which they succeeded in killing the effort of the competing concern to obtain favorable rates, thus forcing the Portland consumers to pay \$1.90 for cement at that time. (Portland Journal, Nov. 8.)

Experiments Show Effect of Fineness of Cement

Results of Over 6,000 Tests of Concrete Cylinders, 9,000 Compression and Tension Tests of Mortar, and Several Thousand Miscellaneous Tests
—Summary of Paper Presented to American Society for Testing Materials

By DUFF A. ABRAMS

Professor-in-Charge, Structural Materials Research Laboratory, Lewis Institute, Chicago

Recent revision of the standard specifications for Portland cement served to focus the attention of engineers on the function of fineness of grinding of cement in producing concrete of high strength and other desirable properties. An investigation of this subject has been under way at Lewis Institute for the past four years. Five series of tests have been completed; another series is now under way. These studies were made as a part of the investigations of concrete and concrete materials being carried out through the co-operation of the Portland Cement Association and the Lewis Institute at the Structural Materials Research Laboratory.

The Portland cements used were from seven commercial mills. These plants represent the principal cement-producing districts east of the Mississippi River. Fifty-one different samples of cement were used. The cements were ground at the mill to four to seven degrees of fineness, which gave residues ranging from 2 to 43% on the standard 200-mesh sieve. In general, the aggregate consisted of sand and pebbles; in one series blast furnace slag and a light-weight aggregate consisting of burnt shale were used.

Nine Subjects Investigated

This paper covers compression tests on 6,125 (6 by 12-in.) concrete cylinders, 9,000 compression and tension tests of mortar, and several thousand miscellaneous tests. Strength tests of concrete and mortar were made at ages of seven days to one year.

Definite information has been secured on the effect of fineness of cement under the following conditions:—

(a) Effect of fineness of cement on the strength of concrete.

(b) Quality of concrete, using different cements.

(c) Effect of the quantity of cement used.

(d) Effect of consistency of the concrete.

(e) Effect of size and grading of the aggregate.

(f) Variation in the type of aggregate.

(g) Effect of age of concrete.

(h) Elongation and contraction of concrete.

(i) Effect of fineness of cement on workability of concrete.

The following may be stated as the principal conclusions from the tests:—

1.—There is no necessary relation between the strength of concrete and the fineness of the cement if different cements are considered.

2.—In general, the strength of concrete increases with the fineness of a given lot of cement, for all mixes, consistencies, gradings of the aggregate and ages of concrete. The cements with residues lower than about 10% were inclined to give erratic results in the strength tests. One lot showed an abnormal increase and two others a pronounced decrease in strength, as compared with the other tests on coarser cements in the same lot.

3.—For residues higher than 10%, the strength of concrete varies approximately inversely as the residue on the 200-mesh sieve.

4.—Fine grinding of cement is more effective in increasing the strength of lean mixtures than rich ones.

5.—Fine grinding of cement is more effective in increasing the 7-day strength of concrete than at ages of 28 days to 1 year.

6.—For the usual range of consistencies, the effect

of fineness of cement is independent of the consistency of the concrete. The rate of increase in strength with fineness is lowered for very wet mixtures.

7.—Ordinary concrete mixtures at 28 days show an increase in strength of about 2% for 1% reduction in the residue of the cement on the 200-mesh sieve. At 7 days, 3 months and 1 year the corresponding increases in strength are about 2.5%, 1.7% and 1.4%.

8.—The decreased benefit of fine grinding of cement with the age of the concrete does not bear out accepted opinion that the coarser particles of cement do not hydrate, but indicates that the principal result of finer grinding is to hasten the early hardening of the concrete.

9.—For the richer mixtures and the consistency necessary for building construction, the fineness of the cement has no appreciable effect on the workability of concrete as determined by the "slump" test. For leaner mixtures and wetter consistencies, the finer cements showed a somewhat greater "slump" than the coarser cements.

10.—The normal consistency of cement is increased with fineness of grinding. About 0.1% of water (in terms of the weight of the cement) must be added for each 1% reduction in residue on the 200-mesh sieve.

11.—The time of setting of the cement is shortened with finer grading. In some instances initial setting time with the Vicat needle was shortened to 5 to 10 minutes.

No Effect on Density

12.—The unit weight of cement decreases with fineness. For the cements used in these tests the weight varied from 76 (residue of 2.4%) to 108 lbs. per cu. ft. (residue 43.3%). For the usual range in fineness, the weight is lowered about $\frac{3}{4}$ lb. per cu. ft. for each 1% reduction in the residue on the 200-mesh sieve.

13.—In using 94 lbs. per cu. ft. as a uniform basis for proportioning the cements in these tests, the actual volume of cement in a batch of the same mix varies about 35%. If the mixtures had been proportioned in a manner that would have given a uniform volume of cement, the resulting concrete strength would not have been so favorable to the finer cements.

14.—The fineness of cement has no appreciable effect on the yield or density of concrete.

15.—Concrete of all mixes and consistencies showed expansion in damp sand or water storage and contraction in air.

16.—The change in length of concrete specimens stored in air or water is independent of the fineness of the cement and the consistency of the concrete. The lean concretes are slightly less affected than the rich mixtures.

17.—The type of aggregate had little or no influence on the relative effect of fineness of cement on the strength of concrete.

18.—The tests included showed an intimate relation between the strength of the concrete and the water-ratio of the mixture. The lower the water-ratio (so long as the concrete is plastic and the aggregate not too coarse), the higher the strength, and vice versa. This confirms the results of other concrete tests made in this laboratory. Increasing the quantity of cement in a given mixture enables us to secure a concrete of

equal workability with a lower water-ratio, hence a higher strength.

19.—In ordinary concrete mixtures (say 1:5 to 1:4, requiring 20 to 25% cement, by volume) increasing the cement content by 1% (to 20.2% for a 1:5 mix), gives an increase in strength of about 1%.

20.—One per cent. increase in cement is more effective in increasing the strength of concrete in lean than in rich mixtures.

21.—One per cent. increase in cement is somewhat more effective in increasing the early strength of concrete than at later periods.

22.—The effect of increasing the quantity of cement is independent of the consistency of the concrete.

23.—Tension tests of briquets do not give a correct measure of the relative merits of different cements as determined by compression tests of mortar and concrete.

Sandusky Cement Mill in Indiana Will Resume Operations

The cement plant at Syracuse, Ind., owned by the Sandusky Cement Company, Cleveland, Ohio, is practically ready to resume operations, and will employ a new method of making cement. Since the company is prohibited from taking marl from Lake Wawasee, it will use limestone, which has been discovered in the vicinity of the plant, at a depth of 400 feet.

Operation of the plant on a large scale, with the employment of about 200 workmen, is expected within a month.

Cement Trial in Oregon Near End

That Aman Moore was discharged as sales manager of the Oregon Portland Cement Company because competitors did not like him was the admission made from the witness stand in federal court yesterday by R. P. Butchart, president of the Oregon Portland Cement Company.

Mr. Butchart was the last witness offered by the defense in the government prosecution against officials of the company for alleged violations of the Sherman anti-trust law. On direct examination the testimony exacted from President Butchart was brief.

"Did you at any time tell Aman Moore that your company had entered into a trade conspiracy with California and Washington cement companies?" he was asked.

"I did not," was his instant response, and no further direct examination was sought.

United States Attorney Haney, on cross-examination, induced the witness to admit that Aman Moore had been discharged as sales manager because competitors of the firm did not like him. He could not remember the names of the competitors who sought Moore's dismissal.

Aman Moore had testified previously that Mr. Butchart had told him of a trade combination by which the Oregon company was not to do business in Washington and California and by which the California companies were to set the price to be charged for cement in Oregon.

The defense yesterday recalled a number of witnesses it had used earlier in the week for re-direct examination, while Wirt Minor, attorney for the defendant company, likewise testified that there was no combination of the Pacific coast cement companies.

The defense rested late yesterday afternoon and arguments to the jury will start this morning. The case should be in the hands of the jurors by late this afternoon. (Portland Oregonian, Nov. 7.)

New Illinois Cement Mill

The Red Star Cement Company, La Salle, Ill., recently organized and given papers of incorporation with a capitalization at \$2,000,000, has opened temporary office in the Matthiessen building La Salle, Ill.

The directors of the company are Fritz Worm and G. T. O. Becker, of La Salle; Clarence Griggs, I. M. Martin and Mr. Hill, of Ottawa. Plans are now under way for the construction of the new plant which will be located northeast of the city on the Carus property, and which will have a yearly capacity of 1,000,000 barrels.

E. L. Cox, for many years general sales agent of the La Salle Cement Company, and an executive of well known ability, is with the new company and will be identified with the development of the extensive plans now in the making.

In the course of the next few months the Red Star Cement Company will have buildings of its own with offices to meet its needs and until this time the company's business will be transacted in its temporary quarters.

The Buda-Ross Electric Light Plant

"The Buda-Ross Electric Light Plant" is the title of a very interesting booklet issued by the Buda Company, Railway Exchange Building, Chicago, manufacturers of the "Buda" motor and supplies for mill, mine, and railroad.

The booklet referred to shows in an attractive and instructive form, the one kilowatt and the one-half kilowatt steam turbo-generator electric light plant manufactured by the Buda Company for lighting small industrial plants using a steam boiler, small steam boats, dredge boats, steam shovels, well drilling rigs, small mines, small saw mills, cotton gins, and any other industry using a steam boiler where the lighting requirements do not run over one kilowatt.

The outstanding features of this lighting plant are:

Size and capacity: The plant is an unusually small one for a steam turbo-generator plant, the smaller size having a capacity of one half kilowatt and the larger size one kilowatt, making it adaptable for lighting small plants and portable outfits.

Simplicity: The steam turbine and the electrical generator are built compactly into one unit. The speed is controlled by an automatic governor and the field coils of the generator have a compound winding which keeps the voltage uniform, on any lamp load ranging from zero to the full capacity of the plant. This makes the operation of the lighting plant entirely automatic, requiring no other attention than turning on the steam when the lights are needed and turning off the steam when lights are no longer needed.

The Buda Company began manufacturing small steam turbo-generators for locomotive headlight service about six years ago. The use of the small steam turbo-generator has grown into many industries and the demand for this kind of a lighting plant has grown to such an extent that the manufacturers have made some recent improvements in it, enlarged the facilities for production, and will market it generally thru dealers as one of the main line of Buda products.

The booklet "The Buda-Ross Electric Light Plant" will be mailed to any address upon request to the Buda Company, Railway Exchange Building, Chicago.

Machines Take the Place of Men on 20-Mile Concrete Road

Grading, Subgrading and Slab Construction Are Machine Operations on Lincoln Highway From DeKalb to Geneva, Illinois

Twin outfits of grading machines, mixers and tampers are putting in 18-ft. slab at the rate of 900 ft. a day on the Lincoln Highway between DeKalb and Geneva, Ill. Both outfits operate from a single loading plant and track system which are to be set up three times for the 20-mile stretch of road. All processes are mechanical, from loading the cars and making the grade ready to placing the concrete slab. Except trackmen and a few shovelers to clean up after the grading machines, to spade behind the mixer and to cover and dike the completed slab for ponding, the workmen are machine attendants. A complete car-camp outfit houses and boards the working force.

The operation comprises 20½ miles of 18-ft. concrete road to be constructed according to the specifications of the Division of Highways of Illinois. Grading runs about 3,000 cu. yd. a mile, with cuts seldom over 1½ ft., all on old gravel-surface road. There are four towns of size, all with railway connections, on the section, but the bulk of the work is not close enough to any town to make it a convenient place for housing the working forces, nor did any have the facilities free for handling the contractor's shipments. This determined the location of the loading plants outside the towns at strategical points with respect to the operations.

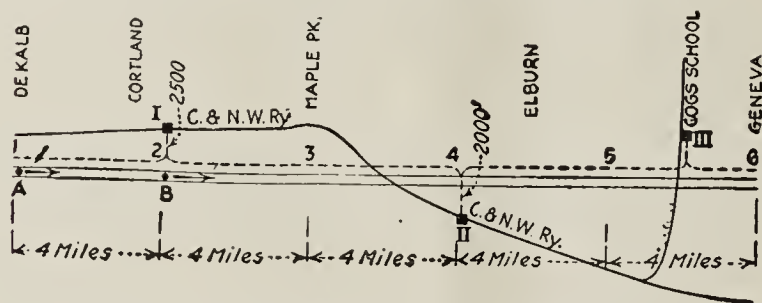


FIG. 1. SUCCESSIVE POSITIONS OF LOADING-PLANT AND SERVICE-TRACK SYSTEM

Dividing the road into four-mile sections, as indicated by Fig. 1, the loading plant with its track system will be set up successively at the points marked by the Roman numerals. One concreting and grading outfit starts at A and the other at B, both working in the same direction. When A reaches point 2, B will have reached point 3. Then the loading outfit will be shifted to II and outfit A will be shifted from point 2 to point 4, when it will proceed to point 5, while B outfit continues from point 3 to point 4. The shift to set up III will be conducted in the same manner, except that from here each outfit will have a two-mile section to build.

At each set-up of the loading plant the track arrangement and procedure are as indicated by the diagram, Fig. 2. There are five miles of 2-ft.-gauge track made up in 15-ft. sections of 25-lb. rail and seven steel ties to a section. At A are the loading bins to which materials are brought on the switch G, on the extension of which stand the camp cars. At B, E, D and F are industrial-track sidings, and at C is the blacksmith shop. One outfit M1 starts at the end of the eight-mile section to which the industrial track is carried. The other outfit M2 starts near the center of the eight-mile section. As M1 moves ahead the track is taken up from behind, carried forward on cars, and put down ahead of M2. When the eight-mile section is completed there is, as stated previously, another set-up of the loading plant.

Essentially, the loading plant is a three-compartment

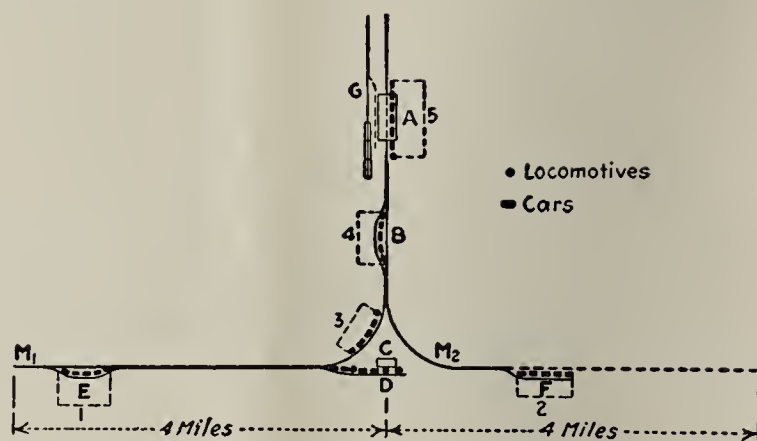


FIG. 2. SERVICE-TRACK DIAGRAM OF OPERATING PROCEDURE

bin, A, straddling the industrial track, a siding for material cars, and a crane track, with two locomotive cranes. The cranes unload from cars into the bins with clamshell buckets or, in case of gravel or sand, when the bins are full, into stock piles from which, when cars are not in, the material is rehandled into the bins. Rectangular flat-bottomed bins are employed, one for each material, but all forming one continuous structure. They discharge to batch-boxes on cars through vertical chutes so spaced that a number of cars receive their charges simultaneously. The bin construction and the details of car loading, particularly in the apparatus and procedure for handling cement in bulk, received careful consideration.

Rectangular flat-bottomed bins were chosen instead of hopper-bottom bins because they cost less to build and could be built, knocked down and rebuilt more quickly. The fact that material pyramided itself on the flat bottom between chutes and remained in dead storage was, in comparison, considered to present no great disadvantage, for when the time came to empty the bins finally a few men with shovels could quickly

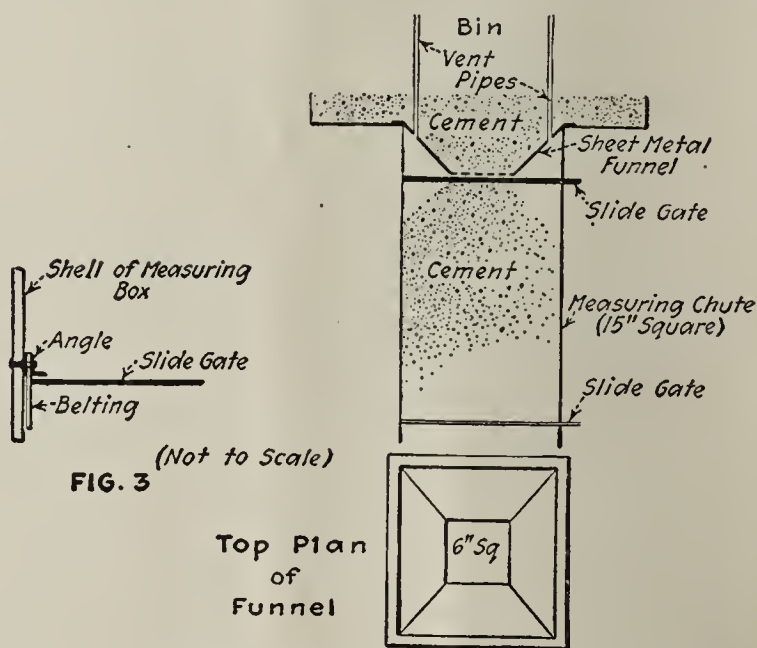


FIG. 3. LEAKAGE OF BOTTOM-CHUTE GATE ELIMINATED BY BELT PACKING; FIG. 4. FUNNEL IN TOP OF CEMENT CHUTE FACILITATES CLOSING TOP GATE

remove the remaining material into the chutes. In fact, the dead storage was held to be an advantage on occasion. When materials' deliveries—and, more particularly, cement shipments—fail at a critical stage of the work and only a little more material is needed to carry the work beyond this stage, the dead-storage reserve will often save the situation from disaster.

Bulk cement is received in flat-bottom gondola cars and is unloaded into the open-top bin by a locomotive crane with a clamshell bucket. Tarpaulin covers for cars and bin protect their contents from rain. Chute construction and operation present the only unusual features. The chutes are vertical, sheet-steel boxes 15 in. square inside and of 4 cu. ft. capacity between top and bottom horizontal slide gates. Dusting at the

charging skip does not always clear itself readily. This objection is considered to be overbalanced by advantages in handling the cement. Were the stone put in first, which would be preferable in charging the mixer, the cement would shake down into the voids to an objectionable degree. The more important disadvantage, however, is considered to be the seepage from wet sand which, if the sand were on top, would be down through the cement. This, in case of any delay in handling the boxes, might start the cement to set and endanger the quality of the mix. Since stone seldom contains free water to any amount, there is little danger of seepage into the cement when the stone is loaded last, and the water in the sand underneath the cement sinks to the bottom of the box, where it causes no trouble.

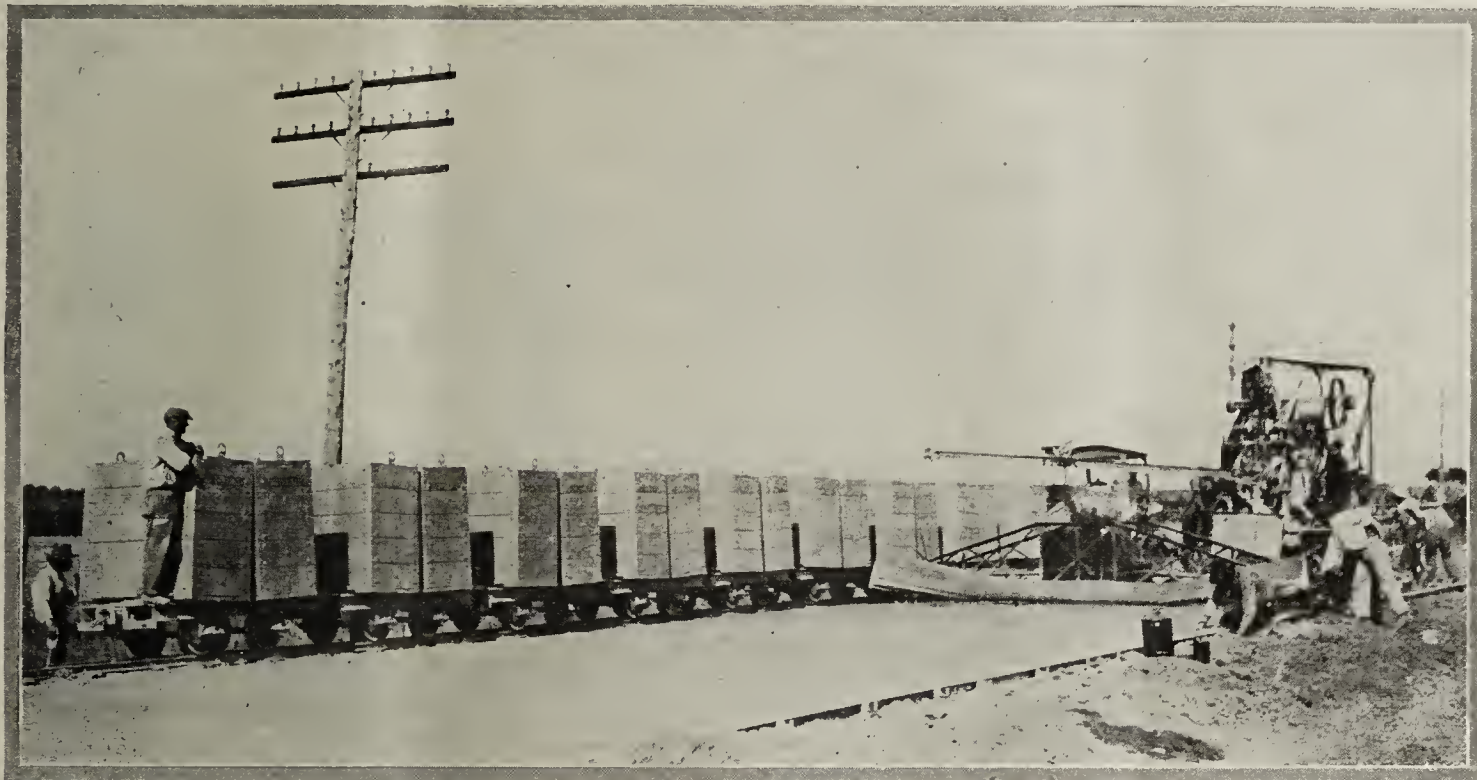


Fig. 5. Cars Drawn by Gasoline Locomotives Delivering Two 4-Bag Batches Each.

joints, leakage at the bottom gate, and difficulty in closing the top gate through the column of cement, caused trouble at the start. Dusting was eliminated by painting the joints with cement paint. Leakage between the closing edge of the bottom gate and the side of the chute was remedied by the arrangement shown by the sketch Fig. 3. The strip of belting suspended as shown formed a cement-tight packing for the gate to close against. To facilitate closing the top gate, a sheet-iron funnel was set into the top of each chute. This reduced, to small dimensions, the column of cement which had to be cut through in closing the gate, and made the closing easy. The vent pipes extending to the top of the bin prevent any trouble arising from compression of the air in the angular space between the funnel and the chute sides.

Scheduled train service maintains coordination between the loading plant and the twin subgrading and paving outfits. With 100 cars and five locomotives, five 20-car trains are so operated that there is always one train taking load at the bins, two trains en route to the mixers and two trains at the mixers being unloaded. Each car carries two batch-boxes, each holding four-bag batch. Fig. 4 shows train equipment.

The boxes are charged first with sand to mark, then with the measured chute of cement, and last to the top with gravel. Since the boxes are bottom-dump, this sequence of sand, cement and gravel is a little objectionable at the mixer because the sand sticks and the

charging skip does not always clear itself readily. When the trains are laid up for the night they stand as indicated by the diagram Fig. 2, in which the circles represent locomotives and the rectangles represent cars. At quitting time train 5 is run under the loading bins; train 4 is laid up in siding B and its locomotive run to siding D; train 3 with its locomotive stands on the main line; train 2 lays up 18 cars in siding F and the locomotive with two cars takes the men on outfit M2 to camp and runs to siding D; train 1 lays up 18 cars at siding E and the locomotive with two cars takes the men of outfit M1 to camp and then goes to siding D. With this arrangement train 3 has a free main line for track shifting or other night work and is ready to run in and take the place of train 5 in the morning. Two locomotives with two cars each are ready to take out the two construction crews and connect up with their trains at E and F. The other locomotive on siding D connects up with train 4, and the day schedule goes into operation.

At the mixers the batch boxes are picked off the cars one at a time by a crane mounted on the mixer, are dumped into the charging skip, and are returned to the car. The mixer has the regulation elevating charging skip, except that the rear end of the skip is closed instead of being open as for charging by wheelbarrows. The batch boxes are of wood, 2 x 3½ x 4 ft., with single-bottom flap doors controlled by a hand latch, and two side irons, with eye-holes for the crane yoke to hook into.

Sequence of Operations

On beginning work (Set-up I, Fig. 1), the grading outfit was started early enough to complete the work ahead of and between mixers M1 and M2, Fig. 2. Thereafter the grading has been kept about three miles ahead of the mixers. The grading outfit consists of an elevating grader hauled by 12 horses and loading into dump wagons which take the material to the shoulders; a scarifier to root up parts of the old gravel road too hard for easy elevating grader excavation; drag scrapers for miscellaneous operations, and a portable camping outfit for men and teams. The camp is moved two miles at a shift, the gang working one mile each way from camp.

The two subgrading and paving outfits are duplicates, and each consists of a 10-ton roller, a blade scraper, a subgrader, a paving mixer and a tamping and finishing machine, besides canvas, steel side forms and the usual small tools. The procedure is the same with both outfits. The roller hitches onto the blade grader, which shapes the grade and ditches close to cross-section. The grade is then rolled down and the steel side forms are set. The subgrade finishing machine rides on wheels on the side forms, and, hauled by the roller, planes the grade down to exact form and elevation. Finally, the subgrade is finished by rolling. All grading operations are machine operations except setting the forms and cleaning up with shovels behind the subgrader.

At the mixer the operations are of the usual order except that the slab is compacted and finished by machine tamping and belting. The paver is a four-bag batch mixer on caterpillar tractions and with boom-and-bucket distribution. The concreting crew consists of two men handling the batch-boxes, one on the crane one operator, one dump man, two spaders, one operator on the tamping and finishing machine, and two men covering the slab with canvas, building dikes and ponding. When the slab has cured, the earth covering will be removed direct to the shoulders by blade scrapers. About 350 ft. of finished slab has been the output for each outfit with the crews being organized; 450 ft. a day is expected when the crews have settled down and all operations are coördinated.

Contrary to road work, usually, the workmen are housed and boarded in construction camps. At the unloading plant the camp consists of an office car, a kitchen car and a mess car and several bunk tents. This camp provides for the concreting, subgrading, unloading plant and train crews. For each grading crew there are a kitchen and mess wagon and a bunk tent which are moved along with the crew, as previously stated.

The contractor is James O. Heyworth, Chicago, Ill., whose superintendent in charge of the work is R. H. Anderson.

Plans have been adopted by the MacDonald Engineering Co. of Chicago for the establishment of a plant at Aransas Pass, Tex., for the construction of concrete barges. The company has entered into a contract with the France & Canada Oil Transport Co. for the construction of several concrete barges which are to be placed in the oil transportation service between Tampico, Mexico, and Aransas Pass. Each barge will be 270 feet long, have a beam of 33 feet and a displacement of 3,500 tons. The site for the proposed ship-building yards has been purchased and the construction of the plant will be started soon, it is announced.

Pre-Cast Concrete Unit Construction The Hahn System of "Concrete Lumber" an Innovation.

Mr. F. R. Hahn, of Decatur, Ill., is the inventor and patentee of a system of precast concrete construction which shows great promise of becoming an important factor in the building operations of the future. Mr. Hahn has called the units "Concrete Lumber Plates"—a most appropriate name. The units may be used for single or double walls.

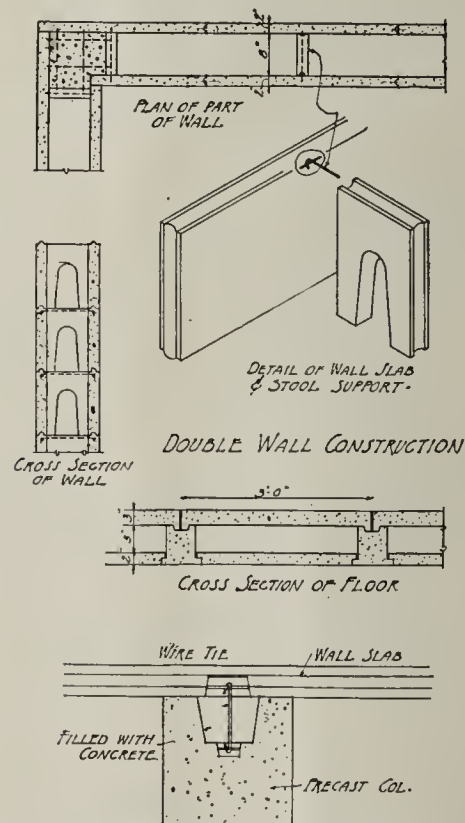
The basic unit is a slab or board 3 feet long, 12 inches wide and 2 inches thick—weighing 72 pounds. The supporting studs are of U section, the open side toward the slab—with an additional recess or socket cast every 12 inches throughout the height—to register accurately with the rows of boards and the spaces provided in the boards for the tie rods which—when grouted in the U hollow of the studs, hold the construction together.



Hahn System Double Wall Construction.

The studs are temporarily supported, carefully placed in proper alignment on the foundation and when the other boards fit in tight without mortar and are self aligning. The grouting in the lining protects the tie rods from rust. The line sketches—shown above—give a clear idea of the construction of these units.

The illustration showing the first step in the floor construction is not the latest model of beam. This is recessed altogether too deep. It is shown correctly in the drawing—which illustrates the floor in cross sec-



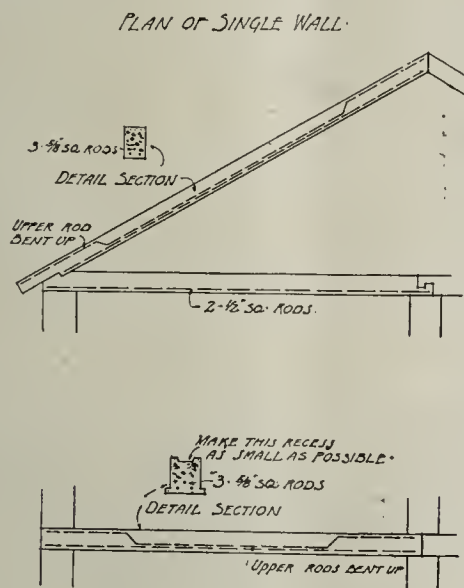
Detail Hahn System of Pre-Cast Unit Construction.



The First Step in the Floor Construction

tion with the lower slab, where flat ceiling is desired, resting on flanges of the beam and an upper slab with protecting slugs to drop into the recess of the beam. If wooden floors are to be nailed down, this recess may hold a wooden sleeper.

Mr. Hahn advises us that after many experiments he has found that pebble dash and stucco is the most suitable medium for outer finish. He has prepared a



Details of Roof and Joists.

small sample wall for demonstrating purposes using Medusa White Cement and Medusa Waterproofing for the stucco. The wall has attracted a great deal of favorable attention. Mr. Hahn's invention certainly opens the way to a more economical and durable method of stucco construction for garages and small structures generally.

News Items

The plant of the Giant Portland Cement Co., Egypt, near Coplay, Pa., has been selected by the Army Department of the Government for the instruction of soldiers engaged in cement work. Early in September a contingent of about thirty soldiers arrived at the plant for a course of instruction in various features of cement manufacture. It is understood that the result of the study will be used in connection with army work in France.

W. J. Armstrong, of Jeffrey Co., Now in the U. S. Army

Mr. W. J. Armstrong, manager of the Crushing and Pulverizing Sales Department of the Jeffrey Manufacturing Company, Columbus, Ohio, has recently received an appointment as Captain in the U. S. Army and assigned to the Ordnance Department in Washington, D. C.

Motor Trucks Haul Heavy Equipment

Freight congestion has made contractors use their wits to get their heavy equipment where it was wanted.

The illustration shown herewith is a big 5-ton Austin cube mixer loaded on a Duplex 3½-ton truck and trailer. It was hauled from Denver to Broadmoor, near Colorado Springs, close to a hundred miles. The trip was successful in every way.

The Wayne County Highway Commission is solving its troubles in a similar way. From its headquarters at Wayne, Mich., equipment and supplies are hauled to the industrial locomotive, which is used for hauling aggregate. It weighs 10 tons and is being hauled on a 10-ton semi-trailer with a 4-ton truck.

Cement Block Company

The Pyramid Cement Block Corporation, Brooklyn, N. Y., also has been chartered, to manufacture artificial stone, etc., with a capital of \$20,000. The directors are Chester E. Mann and William E. Purdy of Brooklyn and Marcus E. Joffe of Manhattan.

Trade Notes

The Liberty Shipbuilding Company, of Houston, Texas, is erecting a new plant, which when completed will be devoted exclusively to the manufacture of concrete ships.

A process of depositing copper electrolytically on any kind of a base, such as plaster paris, wax, cement, crockery ware, glass bottle, mirrored glass of different types and shapes, papier mache, as well as ordinary paper, is now being used by a Boston (Mass.) concern, according to the Electrical Record.

The method is also being used to plate aluminum and build up heavy coatings of copper on other metals where a high polish is desired and a rustproof covering essential. The process makes use of the general principle employed in the making of electrotypes from wax impressions.

Cement statuary covered with a heavy copper coating and finished in bronze stands up well outdoors and takes the place of cast bronze statues.

Next We'll Have Concrete "Woodwork"

A new form of concrete into which nails may be driven after it has hardened, as easily as they could be hammered into wood, has been invented by the director of the public works laboratory at Ottawa, Canada. It is being tried out in the new Parliament Building at the Canadian capital, where, among other novel uses, it goes to form the ceiling of the large chamber. The new building material is said to take a high polish, or it can be stained and grained to look like ordinary woodwork. It is prepared and applied in much the same manner as ordinary concrete.

Cement Chemist

Harry Pomerantz, 940 Lamar Street, Memphis, Tenn., formerly with the Pacific Portland Cement Company, and later with the Main Agricultural Company of Hawaii, as chemist, was recently discharged from the army and is desirous to get into the cement business again.

Limestone for the Beet Sugar Industry

The limestone used in refining beet sugar must be of high purity—of from 96 to 98 per cent calcium carbonate—and, in blasting it, great care must be exercised to produce the stone in such physical condition as will permit its most economical use by the refinery. After the stone is blasted, it is screened to proper size; that is, to about four to six inches in diameter.

Sugar beets are grown successfully in many states, of which Colorado, Michigan, Ohio, Utah, Idaho and California are the largest producers. In Weld county, Colorado, it is reported that 70,000 acres of sugar beets have been contracted for. If a normal yield is obtained, the sugar beet producers will receive approximately \$9,000,000. This production will make Weld county, Colorado, the largest sugar beet producing county in the United States.



Quarries Like This Supply Limestone for the Refining of Beet Sugar.

As with any other crop, soil, subsoil, topography and climate, all figure in the growing of sugar beets. Almost any fertile soil capable of producing other good crops, if properly handled, will be satisfactory for sugar beets. It is impossible for the beet roots to penetrate a surface soil underlaid with a hardpan. If the hardpan be a close, compact, earthy formation, however, the condition can be overcome by blasting with dynamite of proper strength; but if the hardpan be of rock and close to the surface little can be done to improve its condition for sugar beets.

Favorable topography is of great value. Hilly country is not generally satisfactory, especially if the hills are likely to wash. Gently or moderately rolling land is the most desirable in sections where sugar beets are produced under rainfall. For irrigated lands, however, it is preferable that soil surface be sufficiently level to permit of uniform irrigation.

Climate is one of the most important factors. The temperate regions are most successful as sugar beet producing sections. Moisture is necessary. This may be in the form of rain or snow or from irrigation. The element of sunshine is also to be considered, for the plants must have light in order to form the sugar from reaction.

After the beets are harvested and delivered to the beet sugar mill, they are washed, sliced and carried to diffusion batteries, where sugar is extracted from the beet chips. The pulp is disposed of as fodder for stock. The raw juice is carried through heaters to the mixing tanks, where milk of lime or saccharated milk is added. After the heating and mixing, the juice is carried into tanks, where carbonic acid is introduced in order to neutralize the lime. From these the juice is carried to the filtering processes and through carbonation tanks to insure clear juice.

The process from this point comprises sulphitation, refiltration, reclarification, again refiltration, boiling and crystalization, separation and granulation. Then the product is ready to be placed on the market for consumption.

Explosives blast the limestone from which saccharate milk of lime, used to purify the raw juice, is produced. Limestone and coke in known quantities are burned in a lime kiln. These kilns are located at the beet sugar refineries, as the gas produced in the kilns is utilized in the sugar refining process. In the "Steffens" process of refining, the burned lime is passed to a crusher, elevated to the grinding mills, where it is ground to a fine powder, which must practically all pass a two hundred mesh sieve. The powdered



After a Blast in a Limestone Quarry.

lime is then elevated to a storage bin. From the storage bin it is passed through scales to the coolers, where it is mixed with a solution composed of molasses and the sweet water from the saccharate filter process. From the coolers the solution is passed through filter processes. The cakes from the filter process are carried to the mixing tanks, where they are mixed with sweet water from the carbonic process. The resulting saccharate of milk is then carried to the raw juice mixing tanks and mixed with the raw juice. The quantity of lime used is determined by the quality of the beets, the fineness of the powder, and the temperature maintained in the molasses solution. A very high tempera-

ture, coarse powder, or too rapid addition of the lime causes the latter to hydrate. Partial hydration of the lime cannot be avoided. If the factory treats only its molasses production, additional lime is necessary for the juice. The consumption of limestone will vary with the quality of lime, and, with practice in sugar beet refineries where the "Steffens" process is not used.

Lime, in conjunction, generally, with sulphur dioxide gas, is the most important chemical used also in the manufacture of raw cane sugar. The amount of lime used in proportion to the tonnage of cane sugar is, however, much less than in beet sugar manufacture; nevertheless, the total quantity of lime used in the cane sugar industry is large in the aggregate. Thus dynamite finds a necessary although indirect use in preparing sugar for table use.

Dynamite Razes School House

The town of Ozark, Alabama, suffered the loss of its High School building as a result of fire. Being a brick structure, the flames devoured the interior and there remained only the outside walls and partitions.

The building's dimensions were 60x80 feet and the height was 40 feet. How substantially it was built may be inferred from the statement that its walls were 20 inches in thickness.

Razing the walls was a task that was not coveted by Ozark's citizens and despite frequent invitations to "do something," the officials accomplished nothing. Attempts to bring down the walls by "charging" them with an army tank furnished a topic for discussion and later an exhibition not at all creditable to the tank nor productive of results predicted. The common practice of taking down the wall "brick by brick,"



After the Fire and Before Blasting.

while possible, did not appeal to laborers. In a quandry as to methods, and with the clamoring citizens calling for action and the erection of a new building, the officials were in a mood to entertain any plan which had the appearance of sanity and success. Accordingly they were in a very receptive state when approached by Mr. E. M. Williams of the neighboring town of Dothan. Just where Mr. Williams got the idea which suggested a way to solve Ozark's dilemma has not been revealed. Its origin was not of vital interest apparently for he found Ozark's "town-fathers" eager to hear what methods Mr. Williams proposed to use to raze the walls of the high school building now the object of much comment. Their eagerness was turned into speculation and then into hesitation when Mr. Williams mentioned the word "dynamite!" Immediately there came to them imaginative pictures of Ozark being literally "blown off the earth." Visions of school house walls being hurled through the air and

demolishing dwellings, stores and churches, and turning the fair fields of Ozark into vertiable Belgian territory loomed before the eyes of those Ozarkians gathered to hear Mr. Williams' plans! But as he described his plans and explained how it was feasible to use dynamite to raze the school house walls without causing an actual disruption of all the terra firma of Ozark, the sanity of his plans was conceded and he was engaged to do a job which was the preliminary to the bigger one of erecting the high school building so urgently demanded.



After the Blast.

Of the methods put into operation by Mr. Williams, a brief description will be of interest. At a point three feet above the ground, holes were drilled in the brick wall about 14 inches deep and large enough to allow the placing of the cartridges with detonator inserted. The charges were confined with a proper amount of clay and mortar. Four shots were fired simultaneously and this performance was repeated four times to completely raze the walls as shown in the accompanying illustration.

Contrary to the expectations of some skeptical Ozarkians, the explosions did not throw the bricks about the neighborhood, but the walls toppled over and conveniently piled the bricks in a somewhat orderly fashion so that the salvaging of bricks was accomplished economically and in such quantities as to materially decrease the number required when the new building was erected.

Mr. Williams has supplied some very interesting and illuminating pictures of the work which he accomplished by a combination of efficient methods and an intelligent application of a few pounds of 40% ammonia dynamite.

The success attending Mr. Williams' performance is of the kind to encourage other town and city officials to adopt the Ozark plan of removing standing walls which menace the lives of citizens and defy the ordinary attacks of labor which does not invoke the "might of dynamite" through fear or ignorance of how to safely and surely use explosives.

Slag Concrete Walls in These Residences

The Carnegie Steel Company are building 50 houses of five and six rooms each at Youngstown, Ohio, which will be sold to workers on a deferred payment basis. Each house stands on its own separate lot with room for gardens, etc.

The walls are of slag concrete which makes these residences almost fireproof.

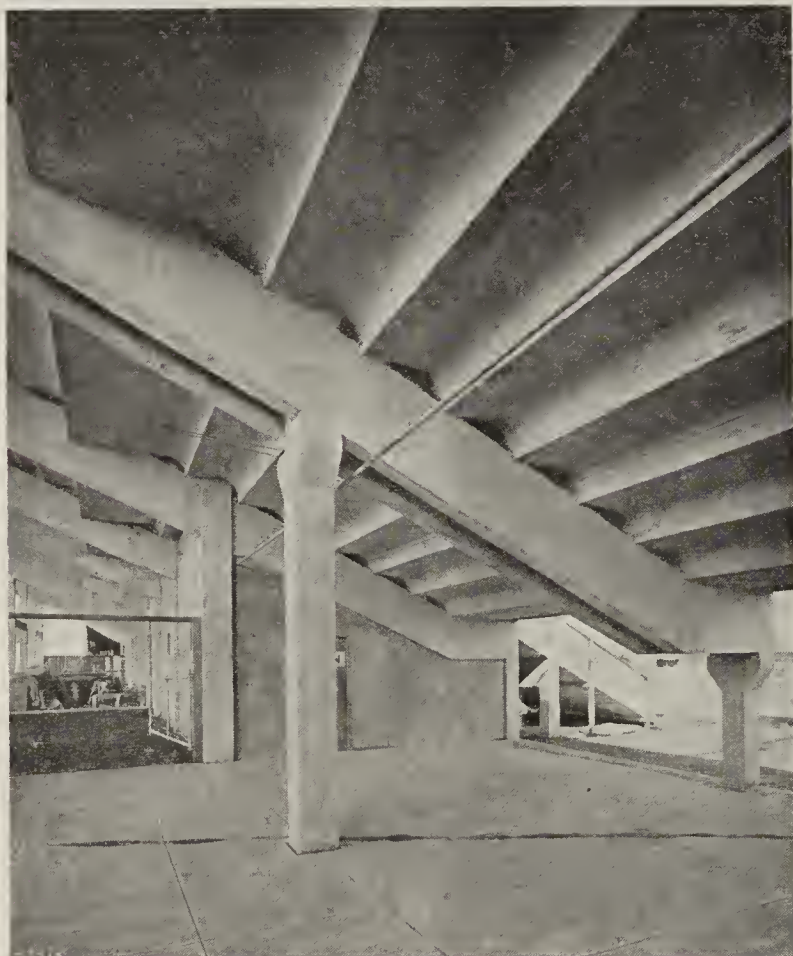
The Huron Grand Stand

By S. W. Jonason

S. W. Jonason & Company, General Contractors of Aberdeen, South Dakota, built in 1918 a reinforced concrete grand stand at a cost of \$55,000, for the South Dakota Fair Association at Huron, S. D. This replaced the old frame structure and has a seating capacity of 5,500 people. It was designed by Homer M. Derr, State Engineer at Pierre, S. D., who had A. Bjordstrup of Mitchell, S. D., act as his superintendent on the job, while Ole Telste, a member of the contracting firm, was the Superintendent of Construction and is entitled to a great amount of credit, not only for his efficient method of handling the various phases of this undertaking, in the face of many handicaps, but also for his exceptionally good foresight.

The grand stand is constructed throughout of reinforced concrete with a concrete roof supported by a steel structure. It is 300 feet long, 60 feet wide and 50 feet high at the back.

All beams, columns and deck were cast together. The beams and columns are spaced 16 feet apart and in such a manner that additional units or sections may be added from time to time.



Concrete Grand Stand.

Expansion joints are made from front to back, thereby having each section entirely free from the other. The slipping due to expansion over the columns on the joints is overcome by the use of rollers set in the joints.

The concrete for seats and decks was deposited on metal lath reinforcing, acting both as forms and reinforcing. After the stand was completed, the underlaid was plastered with a cement mortar and washed with a White cement. This set off the grandstand in an excellent manner, and made the rooms underneath very light. Spacious rest rooms and booths were provided under the stand on both sides of the center entrance, and in time all space will be paved with concrete and used for exhibits. Seats are made of 2x12 planks and attached to the stand by inserts set in concrete at the time of pouring.

The concrete was mixed at a central point and elevated in a bucket tower at the back and center of the stand. On the top a runway was made for carts to carry the concrete from the tower to the portable chutes. This chute was made of lumber, and ran from the top to the front of the stand, making continuous trough of about 80 feet. Small gates were provided on the side of the chute and when opened



View Showing Reinforced Concrete Grandstand. In Particular Note the Concreteing Plant

would close the chute at any point, and divert the concrete into the forms at that point. The chute was on two tracks about 40 feet apart. This made it possible for the workmen to move the chute from one end of the stand to the other, as the forms were filled. This device proved very satisfactory and cheap to construct and operate.

Cement Mill News

Edward H. Hennessy, for ten years manager of the sales department of the Alpha Portland Cement Company, died suddenly at the Northampton Country Club, Easton, Pa., while attending a social function. The party had partaken of a late dinner and was indulging in dancing when Mr. Hennessy, who was seated talking to a friend, suddenly fell forward and expired.

Mr. and Mrs. Hennessy had expected to leave here today for Chicago and then go to Florida for the winter.

The board of supervisors is in favor of purchasing and operating a cement plant for the county, W. K. Bowen, member of the board from Mesa, has announced, according to Miami, Fla., News. Since cement must be used in the construction of the roads for which \$4,000,000 was recently voted by county taxpayers, the supervisors are anxious to secure this material at a reasonable price.

County Attorney Laney, when questioned as to the legality of the county's owning and operating a cement plant, stated today that he had not been asked by the board of supervisors to give an opinion on the matter, and would not make such an opinion public until the request came from the board.

Seventh Street Reinforced Concrete Bridge, Lynchburg, Pa.

By George A. Ricker

Seldom does an engineer have the opportunity in planning one structure to accomplish so many desirable objects as were attained in the case of the new Seventh Street Bridge, Lynchburg, Va.

This reinforced concrete viaduct crosses a broad river, a mill race, a canal, a small tributary river and eliminates five dangerous grade crossings on three streets which were all subject to heavy vehicular traffic. It acords also a striking instance of the adaptability of reinforced concrete. No other type of construction could have so acceptably solved the many problems presented. Maintenance will be reduced to a minimum, and a very handsome general design with tasteful details has resulted in a structure that will always be satisfying to the eye and possess in all its features the largest measure of utility.

Conditions in the vicinity of the site of the Seventh Street Bridge were originally very bad for the city and the railroads entering it. Lynchburg is located on a hill overlooking the James River, while the Norfolk & Western, Southern, and Chesapeake & Ohio railroads enter it on a narrow strip of flat land at the base of the hill between the city proper and river front.

The length of this viaduct with its branches and ramps and the many changes of elevation makes difficult the taking of pictures that will give any comprehensive idca of the structure. The three views that are shown herewith will help to a better under-



Showing Five Arches, Each 110 Feet Span, Concrete Bridge At Lynchburg, Va.

standing of the difficult problem presented to the engincer and the very satisfactory manner in which they were met and solved by him.

Orange Avenue was a continuation of Seventh Street on this low flat land and here were found the three railroad crossings at grade. By the climination of these crossings and the construction of the viaduct great improvement has been made in the grades of Seventh and several connecting streets, which were from 11 to 16 per cent, and are now reduced to 6 per cent.

The platforms in the Union Station, located at the foot of Eighth Street, on the lower level, extend in both directions so that long trains blocked the crossings of Seventh and Eighth Streets. The law does not allow a crossing to be closed for more than five minutes. This being a transfer point for both mail and express, practically all through trains stand in the station from 15 to 20 minutes. Under the old conditions it was necessary to maintain yard and engine crews to cut trains to keep crossings clear. By carrying streets overhead this difficulty was obviated.

Three ramps leading up to the main bridge now afford entrance and exit over $6\frac{1}{2}$ per cent grades to the freight houses of the several roads.

The idea of building this structure originated in the mind of Ernest Williams, President of the Chamber of Commerce of Lynchburg, in 1913.

A steel structure was first contemplated, but after getting estimates and conferring with the engineers of the various railroads, it was decided that a reinforced concrete bridge would be much better in every way. In August, 1914, a contract was entered into between the City of Lynchburg and the three railroads concerned, and a commission was appointed to represent the city, composed of Ernest Williams, President of the Chamber of Commerce, Chairman; Wm. King, Jr., President Board of Aldermen; John P. Pettyjohn, Chairman Committee on Streets; H. L. Shaner, City Engineer. B. H. Davis of New York, a concrete construction specialist, was employed as the engineer to design and supervise building of the viaduct.

The contract between the city and the three railroads provided that the city would (1) Furnish land for approaches on both sides of the river. (2) Pay all property damages incurred. (3) Construct the approach on the north side of the river. (4) Contribute \$50,000 in cash. (5) Close the grade crossings over the three railroads on the several streets mentioned. (6) Maintain the structure after completion. The railroad companies assumed the responsibility of the construction, contract was awarded to M. M. Elkan, of Macon, Ga., and work was begun in October, 1916. The bridge was practically completed in January, 1919.

The original estimated cost of the structure alone was \$365,000. The final cost, including the approaches, which have not yet been completed, will bring the total cost to an amount slightly over \$500,000.

Airtight Containers for Shipping Lime

We sometimes hear it said that there is nothing new under the sun, and it would seem that the airtight container was not as new, with rference to the lime industry, as we had supposed. We have just received word from one of our Canadian members that they have been using airtight steel containers for several years and have experienced the very greatest satisfaction in its use. They have stored quicklime in their containers for fifteen months and at the expiration of that time found the contents in very good condition.

Their sales during this summer arc estimated at 50,000 200-pound barrels.

They are using what they call a semi-steel barrel, 16 inches in diameter, consisting of two wooden ends and 28-gauge steel body. These casks are made up at their plant.

Should any member company desire further information relative to this particular type of container, we shall be very glad to secure it for them. We believe, however, that the all-steel container is a preferable package.

We are informed by the Draper Manufacturing Ccmpany of Cleveland that they are working their various departments day and night getting ready to produce the airtight lime container in lots of 10,000 per day. There are about twenty-five of our members who have now signified their interest in this matter and we shall be glad to hear from any others who wish to know more about this subject. Yours truly,

Robert F. Hall,

General Manager, Lime Association, Mather building
Washington, D. C.

Safety Factors in the Use of Explosives in Cement Rock Quarrying

By Dr. Walter O. Snelling, Director of Research,
Trojan Powder Company, Allentown, Pa.

A cartridge of explosive may be thought of as a small bundle in which a very large amount of energy is bound up in latent form. Just as a knife owes both its usefulness and its danger to its sharp cutting edge, so it is the ability to explode which gives an explosive its utility and its hazard.

By a better knowledge of the characteristics of explosives, and a more complete understanding of the proper methods for their handling, the number of accidents arising from their use is constantly decreasing. Accidents do not "just happen"; behind every accident there must be a chain of circumstances which lead, step by step, up to the final result, and the more complete our information is in regard to the influences of all the factors entering into any given operation or procedure, the simpler it will be finally to bring that operation or procedure to a basis in which the chance of accidents will be reduced to a minimum.

It is always helpful to bear in mind that explosives form no exception to the general rules of cause and effect. In order to liberate the energy that lies latent in a cartridge of explosive it is necessary to apply to the explosive material a sufficient impulse of some sort to commence the chemical changes which we call detonation. Friction, or a heavy blow, or even a very tiny spark, may be sufficient to start the cycle of chemical and physical changes which lead to explosion, but without such primary impulse the explosive will remain inert and its bound energy will be dormant for months or even for years. Accordingly it becomes quite important for everyone whose work has to do with explosives to become as familiar as possible with their characteristics, and to acquire a thorough knowledge of the principal conditions which may lead to accidents in connection with their use.

The first point at which the quarry superintendent is likely to be concerned with the handling of high explosives, is in unloading the car which brings the material from the manufacturer's plant or magazine. The manner in which the cases are packed in the car is prescribed by the rules of the Interstate Commerce Commission, the method having been carefully worked out with the thought in mind of reducing transportation risks to a minimum, and insuring the consignment of explosives reaching its destination in good condition.

It is quite uncommon to have a car of explosives arrive in damaged condition, but where the contents are found to be damaged, and cases are broken or otherwise in improper condition the matter should be reported to the transportation company, and the condition of the damaged cases should be carefully determined. If there is evidence that the roof of a car has leaked it is always advisable to examine the condition of the cases of explosives under the leak quite carefully. Nitrostarch explosives when very wet become insensitive and difficult to explode, while nitroglycerin explosives under the same conditions tend to "leak" nitroglycerin, and this free nitroglycerin is of course far more dangerous than is the nitroglycerin in absorbed condition in the original explosive. Cases of explosives which show exudation of nitroglycerin should be handled with the most extreme care, and every precaution should be used to avoid any friction, or any jam or blow that might be sufficient to cause an initial explosion which would undoubtedly communicate at once to the entire lot of explosives.

In unloading a car of explosives, just as in handling the cases of explosives in all subsequent operations, care should be taken to avoid unnecessary rough handling. It is true that cases are on record where boxes of dynamite have fallen in quarries for a vertical distance of 100 feet or more without explosion, and it is also true that railroad accidents have occurred in which cars loaded with explosives have been literally torn to pieces without explosion resulting. It is just such facts as these that make it so difficult for the average user of explosives to hold a proper mental conception of a degree of care which should be used in handling explosives, and to draw a clear distinction between that over cautiousness which leads to a general fear of explosives on the one hand, and such careless handling on the other hand as amounts to true foolhardiness.

A case of high explosives need not be handled with quite the same care that would be given to a crate of eggs, nor can it be handled with quite the same roughness that would be used with a block of stone. Between the two extremes lies that safe ground which leads to the handling of a case of explosives with that degree of care which its nature warrants, and yet with the absolute assurance that when handled in this careful way the case of explosives is practically as safe to handle as any other box of like weight would be.

It is needless to say that the throwing of cases of explosives from a car to a man on the ground is to be condemned, as is also the too rapid passing of cases of explosives through a chute. I have often seen explosives loaded through a chute of considerable length, and once during the unloading of an explosive from a boat I saw a case of explosives broken open by striking another case of explosives which had become stuck at the bottom of the chute. I do not doubt that this sort of handling could be repeated many times without explosion, but nevertheless I feel confident that the operation involves some risk and is therefore to be condemned. The handling of the cases, a few at a time by means of a small truck is decidedly preferable to the use of a chute unless it is quite a short one, and the passing of a case of explosives from one man to another is a great deal better than the throwing of the case, with the possibility of the man failing to make a good catch and dropping the case.

A good deal might be said as to magazines for the storage of explosives. It is most desirable that a magazine should be water-tight and well ventilated, and in addition should be located sufficiently far from surrounding buildings to offer proper safety. As to the actual type of construction for a magazine opinions differ widely. The Bureau of Mines advocates magazines made of cement-mortar, and Tech. Paper 18 gives a rather full description with bill of materials for a magazine with a capacity of 20,000 to 30,000 lbs. of explosive. At the time the Tech. Paper 18 was published the cost of a magazine of this kind was \$400.00, but the price would of course be materially higher at the present time. The walls of the Bureau of Mines magazine are 6 inches thick, and the roof and door, both of which are also of cement-mortar, are 3 inches thick.

The principal advantages of cement mortar of the composition suggested by the Bureau of Mines is that the material is substantially bullet proof, and yet

crumbles so readily under a blow such as would be produced by an explosion as to greatly reduce the danger from large flying pieces of material.

Where it is desirable to carry a large stock of high explosives at a quarry, it is preferable to provide a main magazine located at a safe distance from the quarry, and an auxiliary magazine close to the quarry for the day's supply of explosives. The magazine for high explosives should always be located a proper distance from the detonator magazine or storehouse, and it very important always to bear in mind that detonators and high explosives should never be stored together. In spite of the fact that the storing of detonators with high explosives has been most strongly condemned by government and state bureaus, and by practically all investigators who have studied the matter, one occasionally sees rather clear violations of this simple rule of safety.

much more sensitive than liquid nitroglycerin, yet frozen explosives, in part because of their rigid condition and in part because of the presence within them of crystals of nitroglycerin, are in unfavorable condition to resist friction and forces which tend to distort the form of the cartridges.

The thawing of frozen explosives should always be carried out at a relatively low temperature, and any effort to quicken the thawing action is to be condemned. When only small amounts of explosives have to be thawed, a double jacketed vessel may be used, in which the heating agent is water at a temperature of about 50 degrees C. (122 degrees F.) The temperature should never exceed 55 degrees C. (130 degrees F.)

While explosives are being thawed their sensitiveness seems to be increased somewhat, and accordingly both during the thawing operation and while the ex-



Cement Rock Quarry

The selection of a magazine site, particularly for the main magazine, is a matter to which some thought can profitably be given. It is well recognized that an outcropping rock ledge forms a less desirable location for a magazine than alluvial earth or sand, since in the event of an explosion the earth waves are transmitted to a considerably greater extent through rock, and destructive effects are thus more extended than when a magazine is on a compressible and less rigid foundation.

Where nitroglycerin explosives are being used during cold weather it is necessary to provide a thaw house in order to insure the explosives reaching the work in proper condition. It is interesting to note that frozen explosives appear less sensitive to a detonator, and more sensitive to ordinary shocks or blows than the explosive in its normal condition. This subject has been under investigation for a number of years, and a large amount of information as to the cause of this peculiar phenomenon has been accumulated. At the present time the belief seems to be that although frozen nitroglycerin is relatively

explosive is still warm after thawing, exceptional care in handling should be exercised.

Where a considerable amount of explosive has to be thawed, it is best to make provision for thawing at one time the entire amount of explosive used in a day, and for this purpose a special thawing house is necessary. The thawing house should be located at a safe distance from all quarry buildings, and should be provided with some means of indirect heating. Technical Paper 18 of the Bureau of Mines describes a type of thaw house which is recommended by the Bureau, and in which exhaust steam or hot water is utilized as a means of supplying heat, the heating coils being placed in a small shed adjacent to the thaw house proper.

"Make-shift" methods of thawing have led to frequent accidents, and it should always be borne in mind that the thawing of frozen explosives is an operation which should be given careful thought. Where electric current is available it has been the custom of some quarries to place resistance coils or resistance bars in a magazine for the purpose of maintaining

a temperature above that at which the explosives freeze, but accidents have been directly traced to this arrangement, and indirect heating, with the heating element placed in an auxiliary fire-proof box connected with the thaw house by a flue or by some other like means, is much to be preferred.

In thawing explosives the use of a high temperature for a short time is much less desirable than a considerably lower temperature for a longer period. Although

temperatures as high as 50 degrees C. (122 degrees F.) are sometimes used a temperature of 40 degrees C. (104 degrees F.) is much to be preferred. The long-continued exposure of explosives in a thaw house should be avoided, and the Bureau of Mines has called attention to the fact that some explosives, such as gelatin dynamites, have been known to decompose and explode after only a few days when continuously heated.

Contractor Devises Method for Simplifying Concrete Alley Construction

By Walter L. Metzel, Metzel & O'Hearn, Contractors, Covington, Ky.

The contractor who has built concrete alleys where buildings and fences are on property lines, with telegraph poles within the right of way, realizes how difficult it is to secure a true convex or concave surface in such confined quarters by the use of hand floats or lutes. If the engineer sometimes omits concrete in the call for bids, it may be because he is not sure the contractor can devise a means for building the alley with a true flow line for the water.

During the past year, Metzel & O'Hearn, contractors, were awarded contracts for concrete paving Bush and Wood alleys in Covington, Ky. The method they developed overcame the objection of one engineer and should be a help to other contractors on similar jobs. These alleys were 18 feet wide, with concave surface having a 3-inch fall from edge to center. A 1:2:3 concrete mixture was used. The concrete was laid 6 inches thick and reinforced with wire mesh. Knowing the objections of H. G. Meiners, City Engineer, to an uneven flow line and in the endeavor to improve on the lute method, a 2 by 6-inch form was set up on each side of the alleys, 18 inches from the property line.

This left 15 feet between forms, into which space concrete was placed, struck off with template and finished with roller and belt as in regular road construction. The boss mixer was set up at alley intersections and concrete buggies were used to carry the concrete to where deposited. The 18 inches between the edge of this pavement and the buildings or property line provided space for the men to handle strikeboard and belt. After the concrete had been allowed to cure for three days, side forms were removed a $\frac{1}{8}$ by 6-inch expansion joint was placed against the concrete, and the 18-inch space to the property line was then paved. This strip was given a pitch of 1 inch to the foot. By handling the work in this way a true surface was secured and the construction simplified.

Buildings fronting on or extending through to alleys are often not on the property line. They either encroach on city property or are back of the property line. The usual practice is to pave the full width between buildings, disregarding property lines if the buildings are within a few inches one way or the other of the line. However, when the time arrives to build a new building, if the alley is a few inches too wide and the builder desires to occupy his entire holdings, the concrete must be cut away. The cut is likely to be very irregular and may destroy the appearance of the alley at that particular point. By the method of



One of the Concrete Alleys in Covington, Ky., on Which the Construction Methods Described in This Article Were Applied.

construction described, the 18-inch strip may be removed if necessary, foundations for new buildings constructed and the space remaining between expansion joint and foundation repaved. In this way the main paving is not disturbed. The longitudinal joints, being within 18 inches of the buildings or fences, receive practically no wear.

Mr. Meiners was so pleased with the appearance of this work that he has adopted it as standard for Covington. Joseph Herman, Commissioner of Public Works, of Newport, Ky., has adopted the same method and has specified that it be followed on five alley contracts recently let.

Pennsylvania Strong for Concrete Roads

Over 376 miles of reinforced concrete roads, costing more than \$13,450,000 have so far been let in Pennsylvania under the \$50,000,000 bond issue program voted last fall.

Up to July 28, the Pennsylvania State Highway Department had let contracts for 470 miles of roads this year. That more than 376 miles of this should be the highest type of reinforced concrete indicates that Pennsylvania is spending its money wisely.

The information Bureau of the Pennsylvania State Highway Department, which has given out the above figures, says that advertisements of new work will continue throughout August and September, so that before the end of the active letting season the concrete mileage will be appreciably increased.

H. Colin Campbell

Waste Heat Boilers Produce Sufficient Steam to Furnish All the Power Required in a Cement Plant from the Exhaust Gases of the Cement Kilns

By F. G. McKelvy, vice-president Alpha Cement Co.

One of the chief problems created by the war was the question of an adequate coal supply. The cement industry was the third largest coal-consuming industry in the nation, with an estimated annual requirement of 8,000,000 tons. One-third of this amount was used for power production, the balance for calcination of the raw materials. The rotary kiln used for the calcination of the raw materials has been justly classified as one of the most inefficient types of equipment, from a fuel consuming standpoint. Only 20 per cent of the fuel consumed is required for calcination, the balance is lost by radiation, carried away in the discharged material from the kiln and in the exhaust gases. It is estimated that the heat loss due to the exhaust gases is approximately 40 per cent, and it is the economical utilization of this heat that concerns us in the topic under discussion.

The amount of heat that it is possible to recover from the exhaust gases of cement kilns varies with the size of the kilns, the capacity at which they are operated, and on whether or not the dry or wet process is used. The total amount of heat can be determined by making analyses of the gases and measuring the temperature in the mouth of the kilns before mixture with the air that is drawn in through the opening between the kiln and the stack base. Continuous sampling of the gases has shown that the degree of combustion in the kiln varies, some samples showing perfect combustion, others an excess of air, and sometimes a defect in the air supply necessary for complete combustion, as a result of which the exhaust gases contain combustible carbon monoxide gas. This latter condition exists when the kiln is being forced to its maximum output and also is due to varying physical and chemical conditions in the kiln. The temperature of the gases leaving the kilns using the dry process will vary from 1000° to 1500° F.; these temperatures being the mean of temperatures taken throughout a day's run. The higher temperature occurs with short kilns operated at high capacities, and the lower temperatures with larger kilns operated at lower capacities. With the wet process plants I am advised that with large kilns the corresponding temperature is about 1,100° F. In all cases the temperatures referred to are the temperatures of the gas in the kiln before mixing with any outside air. If carbon monoxide gas is present and only sufficient air to burn it leaks into the system, the temperatures would be increased after combustion. As a matter of fact, however, the leakage is always excessive, so that the temperatures taken in the stacks are much lower than the temperatures given, and probably on this account the amount of heat that is carried by the gases has in some instances been underestimated.

Not only will there be quite a wide variation in gas temperatures and analyses in different plants, but there will also be a variation in gas weights for a given output, due to the varying amounts of coal used in the kilns. It is consequently impossible to analyze any one set of figures and state that they are representative. I have, therefore, given in a tabulation below sets of figures applying to what I would consider are the extreme conditions, as well as a set for the average. The first column would apply to a plant using the dry process, with short kilns forced to large output, and the third column to a plant using the wet process, with large kilns operated without forcing. Column 2, I believe, represents an average plant. It is difficult to

make a comparison on a barrel basis, as the quality and quantity of coal used varies. Therefore, the calculations below are based on a fixed quantity of coal burned in the kilns, both the ton and the pound being used as a means of comparison. It is assumed that the coal would run about 13,500 B. T. U.'s per pound and would require 11 lbs. of air for complete combustion. The gas weight leaving the kilns has been taken as 14 lbs. per pound of coal, so as to cover the weight of the CO₂ driven off from the rock. In the first instance the weight of air per pound of coal would prob-

TYPICAL SETS OF CALCULATIONS TO DETERMINE THE AMOUNT OF STEAM THAT CAN BE PRODUCED FROM WASTE GASES LEAVING CLINKER KILNS.

	I	II	III
Weight of gases leaving kilns per ton of coal burned.....	28,000	28,000	28,000
Temperature of gases leaving kilns—deg. F.....	1,500	1,300	1,100
Carbon monoxide in gases—%.....	3.0	1.0	0.0
Sensible heat carried by gases above zero deg. F., B. T. U.'s			
.260 x 1500 x 28000.....	10,920,000		
.255 x 1300 x 28000.....		9,282,000	
.250 x 1100 x 28000.....			7,700,000
Heat from the combustion of the carbon monoxide, B. T. U.'s.....	3,738,000	1,246,000	.....
Total heat carried by gases—B. T. U.'s.....	14,658,000	10,528,000	7,700,000
Loss by radiation—5% B. T. U.'s.....	733,000	526,000	372,000
Heat in gases entering waste heat boilers—B. T. U.'s.....	13,925,000	10,002,000	7,328,000
Heat in gases leaving economizers assuming 30% leakage in entire systems—B. T. U.'s—			
1.30 x 28000 x 24 x 350....	3,058,000	3,058,000	2,058,000
Heat absorbed by boilers and economizers—B. T. U.'s.....	10,867,000	6,944,000	4,370,000
Equivalent boiler horse power....	324	207	131
Pounds of steam produced from feed-water at 200 deg. F. into steam at 200 lb. pressure, 100 deg. super-heat.....	9,960	6,370	4,000
Steam required for driving induced draft fan.....	500	500	500
Steam available for power and other purposes—lb.....	9,460	5,870	3,500
Steam available for power and other purposes per lb. coal burned in the kilns.....	4.73	2.93	1.75

ably be less than 11 lbs., and the weight of the CO₂ somewhat more than 3 lbs. It is assumed, however, that the two variations would correct each other, and the figure 14 has been used in all cases. The amount of heat that can be turned into steam is based on certain assumptions that are stated in the tabulation and will be discussed later.

It will be noted from a study of this table that the amount of steam produced is greater, the more inefficient the kilns. A dry-process mill with short kilns, using, say 100 lbs. of coal per barrel, would have available for power purposes 473 lbs. of steam, or sufficient to generate 20 kilowatt hours as measured in electrical power, even with an inefficient prime mover and 30 kilowatt hours or more, with a modern steam turbine equipment. There are not many mills to which these figures apply, as they represent an extreme condition. For most mills the figures in Column 2 will apply, with a coal consumption of 90 lbs. per barrel. The steam available for power purposes is then 264 lbs. per barrel, which, with an economical power plant and power transmission system, would be about sufficient for all purposes. There are few mills with steam and transmission equipment of the best, so that it would be necessary for the others to produce some steam in addition to that supplied by the waste-heat boilers. In a wet-process mill contemplated in the figures given in Column 3, the coal used in the kilns per barrel of cement would at least be 120 lbs. per barrel capacity, or about 80 per cent of what would be obtained in a mill contemplated in making the figures of Column 2 of the comparison.

The heat carried by the gases leaving the econo-

mizers has been estimated on the assumption that the temperatures of the gases leaving the economizer would be reduced to 350 degrees Fahrenheit, and that the leakage through the whole system, including the kiln housings, collecting flues, boiler and economizer setting, is 30 per cent. With a well designed installation, having properly proportioned boilers and economizers, carefully built flues and airtight seals around the opening between the kilns and the housing, these results can be obtained. They represent what I consider best practice at the present time. Even so, the heat carried in the flue gases leaving the economizer is a high percentage of the total heat leaving the kilns. The exact figures for the three cases are, respectively, 22 per cent, 30 per cent and 42 per cent. If the gas temperatures had been 700° in place of 350°, these percentage figures would have been doubled and the steam produced would have been reduced to 70 per cent of that given for the first case, to 60 per cent of that in the second, and to less than 30 per cent of that for the third. If the air leakage had been greater than 30 per cent, which represents the best practice, there would have been a still further reduction in the amount of steam available. I point this out as it shows why installations made some years ago were not as successful as those recently made, where results have been increased by more efficient boilers and economizers and better construction and design of flues and connections. I will not enter into a discussion of the advantages of the modern type of waste-heat boilers with long gas passages, and the high velocities of gas flow, as they are explained in trade publications, but I wish to mention that it would appear that this type of boiler is also better adapted than the ordinary boiler to handling gases carrying a large quantity of dust, such as is carried by the gases leaving cement kilns, and this undoubtedly has contributed to its success.

Actual installations of waste-heat equipment have been made according to two different plans. According to one plan, a separate boiler is installed for each kiln. With the other plan, all the kilns are connected together by a common flue, to which as many boilers as necessary are also connected. The first plan seems to have been the one used in Europe, and in a few installations that were made in this country prior to some three years ago. More recently it has been followed in the installation made at the Buffington plant of the Universal Portland Cement Co. The second plan has been used in the installations made by the Alpha Portland Cement Co., and at the plant of the Dexter Portland Cement Co., and in an installation made in the Argentine by the International Portland Cement Co. At the Louisville Portland Cement Co.'s plant, at Speed, Ind., one boiler has been connected to two kilns and two different installations made. In all of these installations, with the exception of the one at Buffington, the stacks formerly connected to the kilns were left in place and dampers put in, so that the gases from the kilns can be diverted to the stacks when necessary. Economizers have been used in each of the installations with the exception of that at Speed, Ind.

In 1916 the Alpha Portland Cement Co. installed at their Plant No. 6, Cementon, N. Y., a waste-heat boiler plant consisting of two 750 h. p. Edgemoor water tube boilers, having 7,493 sq. ft. of water heating surface, designed for 200 lbs. steam pressure and 100° superheat. The exhaust gases from five rotary kilns (3 kilns 9' x 120' and 2 kilns 7' x 120') are discharged into a main flue located immediately back of the kiln stack bases. From the main flue there is an individual connection to each boiler, which is of the four pass type. The gases after leaving the boilers are passed through Green fuel economizers of specially designed horizon-

tal type and through flues leading to an exhaust fan driven by a direct connected steam turbine.

The boilers are equipped with soot blowers and clean-out doors in each pass, so that the tubes can be cleaned off with a lance. Recording pyrometers are installed to record the temperature of the gases leaving each kiln and recording thermometers to measure the temperature of the exhaust gases, leaving the economizers and the temperature of the feed water to the economizer and to the boilers. The boilers were put in service in November, 1916, and after two months' service in connection with the direct-fired boiler plant, it was found possible to generate sufficient steam in the waste-heat boilers to take care of the entire power requirements of the plant, which average 2,200 Kilowatts. This result was due to having a modern turbo-generator unit to generate the power required for the plant, and to constant supervision of the waste-heat boiler installation. A competent man was constantly employed analyzing the gases from the kilns and observing the temperature of the exhaust gases and the temperatures of the water going to the boilers to determine the efficiency of the boiler system. Trouble had been anticipated with the collection of dust on the boiler tubes, but this was overcome by cleaning the boilers with the lance, as well as employing the soot-blowers.

On account of having installed with the waste-heat boilers a Cottrell treater for dust collection, careful determinations had been made of the amount of dust in the exhaust gases. After the boilers and Cottrell treater were put in operation, it was found that out of a total dust loss daily of 44 tons, 2½ tons were collected in the kiln housings, 4½ tons in the main flue preceding the boilers, 6½ tons in the boilers and economizers, 28½ tons in the Cottrell treater and 2 tons discharged into the atmosphere.

Improved draft regulation and careful check of the gas analyses resulted in better kiln operation and an increased output. The daily clinker production in 1916, before the waste-heat boilers were in operation, was 2,625 bbls. In 1917 the daily clinker output was 2,877 bbls., and for the first six months of 1918 the daily output was 2,908 bbls. The fuel consumption in 1916 was 96 lbs. per barrel in the kilns and 61 lbs. per barrel for power; in 1917, 96 lbs. in the kilns and 6 lbs. for power; for the first six months of 1918, 96 lbs. in the kilns and 22 lbs. for power. The fuel required for power purposes in 1917 and 1918 was used in the direct-fired boilers operating packing house, fire pumps, heating the plant, etc., when the plant was shut down. The higher consumption in the first six months of 1918 was due to the fact that the plant was not in operation until March 15, 1918, and the total output for the period was much smaller than usual.

Based on results obtained from the waste-heat boiler installation at Plant No. 6 in 1917, the Alpha Portland Cement Co. decided to install a waste-heat boiler plant at their Plant No. 3, Martin's Creek, Pa. This plant is similar in design and construction to their Plant No. 6, with the addition of one 750 h. p. Edgemoor boiler of the same type as the two boilers installed at the Cementon plant and having individual turbine fan drives on each boiler. This plant was put in operation in February, 1918, but due to complete failure of the steam turbines driving the draft fans it was not possible to operate the plant efficiently until August, 1918. Since that time there has been a saving of approximately 50 per cent of the fuel required for power purposes. It is impossible to make a greater saving, on account of the high steam consumption of the prime movers in use at this plant. It is expected that with the installation of a modern steam turbo-generator unit

with low steam consumption, that the waste-heat boilers will produce sufficient steam to operate the entire plant.

From the two years' experience we have had with waste-heat boilers, I am of the opinion that with a modern waste-heat plant and prime movers with low steam consumption and a properly designed power

transmission system, it is possible to produce sufficient steam to furnish all the power required in a cement plant from the exhaust gases of the cement kilns, to reduce the coal consumption per barrel approximately one-third, an annual saving of at least two million tons in the cement industry, and effect a reduction in the manufacturing cost of five cents per barrel.

Concrete Fuel-Oil Tank Design and Construction

Precautions To Be Observed in Building Small Oil-Storage Reservoirs for Use in Industrial Plants

Fuel-oil tanks of concrete became quite common during the war on account of the shortage of steel and the increase in liquid fuel to take the place of the coal which was hard to get. The following paper is an abstract of one on the subject of such tanks read by H. B. Andrews, consulting engineer, of Springfield, Mass., at the recent convention of the American Concrete Institute.

The reservoir should be located a safe distance from inflammable structures as far as possible consistent with pumping requirements, and should be covered with at least 18 in. of earth, if near buildings to decrease fire hazards and also to minimize oil evaporation. If distant from buildings it should be at least half underground, and, if possible, the excavated material should be used in banking up around it.

The reservoir should be limited in size for two reasons: First, the necessity for not exceeding a day's working limit in operation of pouring concrete so that joints between operations may be eliminated, and second, so that in case of an accident or fire in any reservoir too much oil in storage will not be involved. This size limit should not be over 300,000 gallons under most conditions, and the majority of contractors have not the facilities to construct properly a reservoir of this capacity.

Reservoirs should be circular in shape, the better and more directly to take care of involved stresses and to avert danger of tensile or temperature cracks. They should be so proportioned and designed as to limit the number of pouring operations of concrete, in order to avoid joints between these operations.

Care should be taken to provide for all exterior stresses, such as hydrostatic pressure from groundwater, earth pressure on walls, and roof if reservoir is buried, and also to avoid as far as possible concentration of loads on walls or footings. Where joints are absolutely necessary they should be so protected that there will be no leakage through them. Regarding hydrostatic pressure, while engineers have found from tests that this pressure in soils is only about 50 per cent of the full head of water, it is not safe to design for stresses less than the full head, as any deflection in the concrete admitting a film of water between the earth and the concrete will produce the full hydrostatic pressure.

Concrete surfaces must be temporarily or permanently protected so that oil will not come in immediate contact with them if the concrete is less than six weeks old.

Falsework must be designed to hold concrete temporarily in place so that it will not fail or be distorted while placing concrete. It is especially necessary to provide for the firm holding of wall forms, as the pressure of several feet of concrete poured quickly as a monolith is intense, and any "give" of the forms

after the concrete has obtained its initial set breaks up the crystals already formed and allows expansion of the concrete mass, with resultant porosity and loss of strength.

Concrete must be so designed that it will resist all exterior stresses to which it is subjected and so that it will be oil-proof. One of the principal features of this design is to make the walls of circular reservoirs in tension sufficiently thick so that the ultimate strength of the concrete in tension will not be exceeded. It is not meant to leave out the steel reinforcement so that the stress will theoretically be borne by the concrete, but nevertheless it will be borne by it unless some unforeseen weakening of the concrete should throw it upon the steel.

An extended investigation, by the writer, on high circular concrete standpipes for water showed that if the concrete in the wall was stressed beyond its elastic limit, or ultimate strength, which is practically identical, vertical hair cracks will appear of sufficient width to admit water into the body of the concrete.

This ultimate tensile strength in a 1 : 1½ : 3 concrete from tests made for the writer at the Watertown Arsenal was 203 lb. per square inch. Where the concrete is in large sectional areas, and reinforced, this tensile strength will probably be somewhat higher. If a stress not exceeding 150 lb. per square inch is allowed in tension there will be no danger of these vertical cracks appearing.

Reinforcement must be so designed that it will take care of all interior and exterior stresses, and with fittings to hold it rigidly in place while the concrete is being poured. Steel in tension in walls should not be stressed over 10,000 lb. per square inch to conform with insurance company requirements. The writer does not think it is necessary to figure the stress as low as this, under usual conditions, as he has satisfactorily constructed many reservoirs using a stress of 14,000 lb. But the lower stress is an additional safeguard against inferior workmanship by inexperienced contractors and against any decrease in bond strength due to oil penetration of concrete. It is probably unwise to depart radically from insurance company recommendations.

All reinforced rods in concrete exposed to oil should be of a deformed section for better bonding value.

For other parts of the reservoir the recommendations of the Joint Committee on Concrete and Reinforced Concrete should be followed.

The concrete should be no leaner than a mix composed of one part of cement, 1½ parts of sand and three parts broken stone or gravel. To this mix should be added a "densifier." Hydrated lime has been found economical and satisfactory for this purpose, using 10 lb. of dry lime to each bag of cement. The stone must be hard and clean, the best material being trap-

rock, granite or gravel. The sand must be free from any deleterious matter, and should be well graded. Cement should be of an established quality.

The concrete should be deposited continuously in concentric layers not over 12 in. deep in any one place. No break in time over 30 min. is permissible in depositing concrete during any one operation, and if any delay occurs amounting to 30 min. or more the previous surface must be thoroughly chopped up with spades before the next layer of concrete is deposited.

The different operations in pouring are (1) The pouring of the floor and footings; (2) the pouring of the entire wall; (3) the pouring of the roof. In small reservoirs the wall forms may be supported so that the footings, floor and wall may be poured in one continuous operation. An approved joint or dam must be made between the floor and the wall.

Concrete should be mixed by a mixing plant of sufficient size and power to carry out each separate pre-arranged operation without danger of delay during the process. The materials should be mixed at least 2 min. in the mixer, using just enough water to obtain a plastic mix without excess water coming to the surface after the concrete is deposited, and a measuring tank should be used so that the amount of water may be kept uniform.

The concrete when deposited in forms should be well spaded by at least four competent laborers who are not afraid to use their muscle in compacting the concrete thoroughly and working out the trapped air bubbles.

Reinforcement should be of round deformed medium steel bars. These bars should be bent or curved true to templates carefully placed in their predesigned location, and rigidly maintained there by mechanical means. No laps should be less than 40 diameters and no two laps of adjacent rods should be directly opposite each other.

The forms should be of a good material, strongly made and braced, or held in place by circumferential bands, that no distortion allowing displacement of concrete during its initial set is possible.

The surface of the floor should be trowelled smooth as soon as it can be properly done. If all previously named precautions are taken, there should be no defects in the wall to correct.

Concrete designed and placed as recommended herein is practically oil-tight, but as oils are somewhat detrimental to fresh concrete it is advisable to put on an interior wash or coating to protect the fresh concrete from the action of the oil, for such a time as may be necessary for it to cure and harden sufficiently. Silicate of soda, while not a permanent coating, has been used satisfactorily for this purpose according to the following specification for oil proofing:

"The surface of the floor and the interior surface of the wall are to be coated with silicate of soda of a consistency of 40° Beaume, and applied as follows:

"First Coat—One part of silicate of soda and three parts water, applied with brush, and all excess liquid wiped off with cloth before drying.

"Second Coat—One part silicate of soda and two parts water applied as above.

"Third Coat—One part silicate of soda and one part water, applied with brush and allowed to dry.

"Fourth Coat—Applied same as third."

Hydrated Lime in Concrete

In the last Weekly Bulletin of the Lime Association mention was made of difficulty arising in Lucas county, Ohio (Toledo district), on the part of the con-

tractor for a concrete road for which the specifications called for $7\frac{1}{2}$ per cent of hydrated lime. The report we had received from the engineers was to the effect that hydrated lime was not performing in accordance with our claims and the contractor wanted to discontinue the use of the material. Our Western district engineer, Mr. Owen, went to Toledo to get the situation straightened out and have hydrated lime stand as specified in the particular contract as well as in other specifications which have been written.

Mr. Owen found that the difficulty was not with the hydrated lime, but rather was brought about by a condition which we find to be quite general on a large percentage of concrete operations, that is, the concrete was being placed altogether too wet. Mr. Owen took charge of the mixing plant for a day and after regulating the water content as well as the proportions of aggregate, the condition was considerably improved.

This is a condition in concrete construction which we constantly have to guard against. Hydrated lime, or any other material, will not overcome the difficulties arising in excessively wet mixtures. What hydrated lime does to concrete is to permit its being transmitted to and placed in the forms with a minimum amount of water. It has been proven by prominent concrete investigators during the past couple of years that the ultimate strength of concrete depends very largely upon the water content used in mixing, maximum ultimate strength being obtained with an amount of water that is smaller than that which can be used in actual practice. A mixture containing the proper amount of water for the development of maximum strength is too dry to be workable. For this reason, the contractor always uses more water than that which is required for the development of maximum strength. The decrease in strength which results with an increase in water content is very marked, so that in order to develop the highest possible strength in field practice it is becoming the practice to use a minimum amount of water, producing a fairly dry mix, and depend upon hydrated lime to furnish the desired workability. In mixtures that are not too wet, hydrated lime satisfactorily functions in this manner, but it can readily be seen that when contractors use excessive quantities of water in addition to the lime, that the water becomes a dominating factor and the lime cannot properly function. As mentioned above, this is a condition which we are constantly meeting with in our field work and it usually requires the presence of one of our field engineers to get the matter properly straightened out. The Toledo situation was handled satisfactorily and instead of hydrate being thrown off the job, the engineers feel satisfied to let present specifications stand and give hydrate the thorough trial it deserves. Yours truly, Robert F. Hall, Lime Association, Mather building, Washington, D. C.

Potash Leaching Plant Successful

The potash leaching plant for the manufacture of pure salts from recovered cement dust, which W. S. Barstow & Co. designed and built for the Ironton Portland Cement Co., of Ironton, Ohio, has passed the period of adjustment and is now in active commercial operation. On September 20 the daily output, which has been steadily increasing, reached 7,000 pounds, being about 15 per cent larger than was estimated as the maximum. The salts are said to be of unusually high grade and analysis, and a carload of 60,000 pounds, sold recently, brought a price above the prevailing market quotation. The plant has been turned over to the owners, who will now conduct operations.

New Features in Indiana's Concrete Road Specifications

Recent Draft Includes Some of the Latest Ideas in Highway Work—Materials and Methods Covered in Detail

A rich concrete, the cylinder test for consistency, combined hand-roller and belt finish, canvas covering and 15-day ponding, and the use of free steel dowels at construction joints, are among the features of the new concrete-road specifications of the Indiana State Highway Commission. These specifications include both one and two-course construction, with and without reinforcement, but the conditions determining the use of these alternative designs are not stated. The concrete slab is 18 ft. wide, with a thickness of 8 in. at the center and 6 in. at the sides.

Proportioning of Concrete

For one-course paving, either crushed stone or screened and washed gravel may be used as the coarse aggregate, ranging from $\frac{1}{4}$ in. up to a maximum size of 2 in. as determined with laboratory screens, with not more than 5% by weight passing a screen having $\frac{1}{4}$ -in. circular holes. The stone must have a French coefficient of wear of 8 and a crushing strength of 16,000 lbs. Sand for the fine aggregate must pass a $\frac{1}{4}$ -in. screen, with not more than 28% and 10% by weight passing the No. 50 and No. 100 screens, respectively, and not more than 3% by weight removed by the elutriation test. A mix of 1 cement, $1\frac{1}{2}$ fine aggregate and not more than three parts of coarse aggregate is specified, but it is required that the total aggregates shall not exceed $4\frac{1}{2}$ parts and shall be in such proportions as the engineer may direct.

Stress is laid upon the cement proportion, with a penalty for skimping. The specified proportion is 1.91 barrels of cement per cubic yard of concrete in place. The engineer is to compare the calculated amount of cement as required by the plans and specifications with the amount actually used each day, this being determined by counting the number of sacks used. If the amount of cement used on any day is 2% less than that specified, the contractor must remove the concrete and rebuild this section of the work.

Concrete mixing is to be done in a batch machine specified to be "of the boom-and-bucket type," the time for each batch being not less than 1 min. after all the materials are in the drum, and during that period, the drum must make not less than 14 or more than 20 revolutions. Measuring boxes, timing devices and a water measuring and discharging device are to be provided. Concrete is not to be mixed when the temperature is at or below 35° F. Both steel and wood forms are permitted, and must be cleaned and soaped or oiled before concrete is placed against them. For the consistency test, a cylinder 6 in. in diameter and 12 in. high is filled with concrete which is tamped until a film of mortar appears upon the surface. Upon raising the cylinder, the vertical settlement or "slump" of the concrete must not exceed 2 in. when a mechanical finisher is being used or 4 in. when the finishing is being done by other methods permitted in the specifications.

For finishing the concrete, the surface is to be struck off or leveled with a steel templet weighing not less than 400 lbs. for a length of 19 ft. This templet is to consist of an 8-in. channel, crowned to the required cross-section and reinforced by an I-beam, T-rail or angle, so as to give it sufficient strength to retain its shape. The concrete is to be rolled transversely with a hand roller having a long handle and operated from one side of the paving. This roller is to be of metal, 6 in. in diameter, 6 ft. long and weighing 100 lbs. It must be passed over the entire width of the paving at each move-

ment, and the rolling is to be continued until free water ceases to come to the surface. The rolling will be followed by a belt finish. The use of a finishing machine is permitted, but no instructions or requirements for this are included in the specifications.

A canvas covering suspended about 12 in. above the surface is to be spread over the concrete as soon as the finishing operations are completed. In addition to this the engineer may require that the surface of the concrete be sprinkled. When the concrete has "hardened sufficiently" this covering is to be removed and the sides of the paving banked with earth. The pavement is then to be covered with water to a depth of at least 2 in., and this ponding is to be maintained for 15 days.

Earth cover at least $1\frac{1}{4}$ in. thick is permitted on grades over 2%, where the ponding is impracticable, the concrete being wetted thoroughly in advance and the material kept continually moist. This cover is to remain at least 18 days, and precautions must be taken to prevent foot traffic for at least three days. Other methods of curing may be permitted. After the concrete has been cleared and swept clean, three days must be allowed for final curing. In no case is traffic to be allowed upon the road until 21 days after the laying of the concrete, while in cold weather the road will be kept closed for such longer period as the engineer may require.

Free Steel Dowels Used at Construction Joints

Expansion joints are not specified, but a plain butt joint is to be made at the end of each day's work by the use of a heavy plank, having its top cut to the proper crown. Steel dowels across the joint are provided to prevent independent movement of the adjacent slabs. These are $\frac{3}{4}$ -in. bars, 4 ft. long, spaced 4 in. on centers and placed 3 in. below the finished surface. They are cased in paper so as to prevent a bond between the steel and the concrete; apparently they are intended to be free for their entire length. Special care is demanded in the making of these transverse joints, in order that the concrete may be true and level on both sides.

Any unevenness amounting to $\frac{1}{4}$ in. above or below the true surface of the concrete, whether at joints or other parts, must be remedied. Depressions must not be filled with concrete unless the slab has been cut to insure a thickness of 4 in. of new material. Where such a patch would have an area of more than 2 sq. ft., the concrete must be cut through to the foundation, for the full width of the slab and a new strip of concrete placed.

Where reinforcement is used in one-course construction, it is to consist of steel fabric weighing at least 40 lbs. per square foot. This is to be in flat sheets of a length 4 in. less than the width of the paving, the sheets being so constructed as to retain their shape during the necessary handling. The transverse laps are 12 in., and if sheets are allowed to be lapped parallel with the center line of the road the lap must be not less than 4 in. The reinforcement is placed 2 in. below the finished surface of the concrete.

For two-course concrete roads, the stone for the coarse aggregate of the top course is to range from $\frac{1}{4}$ in. to 1 in., with not more than 5% by weight of the minimum size. If screened and washed gravel is used, it must contain at least 25% of stone and pebbles. For the bottom course, a 1:6 mixture of cement and aggregates is specified, approximately a 1:2:4 mix and hav-

ing not less than 1.57 barrels of cement per cubic yard. For the top course the proportions are $1:3\frac{1}{2}$, approximating a mix of $1:1\frac{1}{2}:2$, with not less than 2.1 barrels of cement per cubic yard. In all cases the proportioning of the aggregates is subject to the requirements of the engineer.

Concrete for the top course must be placed as soon as possible after the surface of the bottom course has been struck, this interval being not more than 30 min. Where the bottom course has not been covered within this time it must be taken up. When reinforcement is required, it will be similar to that for one-course paving, but will be laid upon the bottom course immediately after it has been shaped in readiness for the top course.

Grading and Contracts

When the subgrade has been shaped to the required cross-section, it is to be rolled with a three-wheel power-operated roller, weighing not less than 10 tons. Loose rock, boulders and soft or yielding material which will not compact readily when rolled must be removed to a depth of at least 6 in. and replaced with suitable material. Where the surface of an old road-bed conforms approximately to the subgrade, it must be scarified to a depth of 8 in., while if the old surface is of telford or other construction made with large stones, the projections must be broken off, and crushed stone added to obtain the required cross-section.

The shoulders must be made of suitable material (not specified more particularly) and rolled as above. Embankments are to be built in layers not more than 12 in. thick, each layer being compacted by a roller as specified for the subgrade. Material containing sand in such proportions as to prevent it from compacting readily when rolled dry is not to be used, except by special written permission.

Provision is made for agreements with contractors as to payment for extra work, and for cases where alterations in plans or construction affect the amount or cost of the work. For the construction done on a force-account basis the contractor will be paid the current local wages for labor, teams and foremen, and the actual cost of materials, including freight rates, with an addition of 15% to both wages and costs. When power-operated machinery is used, rental will be paid on the basis of hours of work.

No bonus is provided for rapid progress, but the penalty for delay in completing work beyond the contract time ranges from \$10 per day, for contracts up to \$500, to \$30 per day for contracts of \$50,000 and over. Monthly payments of 80% of the estimates are provided. Continual inspection is implied, it being specified that work done or materials used without supervision or inspection by a representative of the state highway commission may be ordered removed and replaced at the contractor's expense.

In addition to concrete roads, the specifications cover vitrified-block and bituminous-concrete pavements, particulars of which will be noted in a separate article. The specifications were prepared under the direction of H. K. Bishop, chief engineer of the Indiana State Highway Commission.

Cement Co. Reduces Its Common Stock to Increase Capital

Reducing its common stock from \$600,000 to \$480,000, the Beaver Portland Cement Company of Portland, Oregon, under permission granted by Corporation Commissioner Schuiderman, will increase its total capitalization to \$830,000 by the sale of 3500 shares of preferred stock.

Brace the inside corners well, with 2x2-inch angle iron.

Derrick Savings in Dollars and Cents

First of a Series of Articles Showing it is Cheaper to Buy Help Than to Hire it

Some builders, especially the smaller ones, employing from five to fifteen men, have long cherished the idea that they could not afford labor-saving equipment. That this is a false and expensive idea is evidenced by the fact that they cannot compete with their more up-to-date brothers.

Proper and sufficient equipment on the job means more work with less men, in a shorter time. Equipment relieves the workmen of heavy lifting and straining, so naturally this results in more cheerful workers, and leaves them to pursue the essential hand work with more vim.

Equipment may be classed as general, and specialty. General equipment, is that used by all trades engaged in the erection of buildings. Specialty equipment is that used largely by one branch.

It is estimated that one-third of the costs of an average job is expended in handling, lifting and placing, the various materials to be used. This applies to most building trades. Then the derrick is one of the most useful units in general equipment.



A Handy and Compact Derrick.

Considerable thought should be given the purchase of a derrick. If the builder is doing work which necessitates the shifting of the derrick from place to place, light and compact one must be chosen. Having this in view, strength must not be sacrificed for lightness. He must next decide the capacity required for his particular work, and if hand or power operated.

The hand derrick is a very efficient machine and will serve the purpose of most builders. Fig. 1 illustrates a very handy and compact derrick. It is easily moved and can be set up in a few minutes without trouble. They are made in capacities of from half-ton up to five ton. The prices of these derricks are very reasonable, and in most cases can be bought on terms to suit the purchaser. The lighter ones require only one man to wind them up, but those of two to five tons generally require two men. Most derricks are rigged for two speeds. Light loads are taken up on high speed, and heavier loads on low speed.

One will be wise to choose a derrick which exceeds the actual capacity needed. This will give a wider working range.

Savings to Bricklayer or Mason

For the bricklayer or mason a derrick is a real money-saver on a job. To get the maximum service in handling brick, mortar, cement, tile, etc., a number of boxes should be made as follows: Use 2-inch stuff and make them 4 feet long, 2 feet wide, and 2 feet deep.

Run 3/16x2-inch iron straps (on the outside) around the bottom, and up the sides, about 4 inches from each end. By means of these straps fasten strong steel loops on the bottom of the box, and hooks on the top. This provides a means by which two or more such boxes can be coupled together, thus taking a number in one lift. Each box when filled with ordinary brick will weigh about 750 pounds, and carry about 350 brick. As many of these boxes as the job warrants should be available, so as some of the brick can be unloaded from the wagons, directly into them. If larger boxes than these are made, they would be found cumbersome to handle.



An actual test made on a job under ordinary conditions proved that a derrick was saving the bricklayer \$1.50 on every 1,000 bricks landed on the second floor of a building in course of erection. From this, one can readily see, a derrick would pay for itself on one fair-sized job. A derrick too, would be found indispensable in hoisting scaffold planks, raising heavy trestles, lifting sills, lintels, etc.

Carpentry Labor Problems Solved by Derrick

The carpenter would find in a derrick a solution to his labor problems. His work is so varied that definite figures are impractical, but can be considered in a general way.

It costs the carpenter at least \$1.00 per 1,000 board feet to land lumber such as flooring, sheeting, rough boarding, etc., on the second floor of a building (by hand). 1,000 feet of pine or hemlock weighs about 3,000 pounds. A one-ton derrick and two men can do it in about ten minutes, taking it in two lifts. Here is a saving of about 60 cents per 1,000 board feet.

A one-ton derrick will lift 85 2x4 inches 12 feet long, or 45 2x8 inches 12 feet long, or 28 2x12 inches 12 feet long, under ordinary conditions. Shingles can be hoisted, nails can be lifted. Heavy beams can readily be picked up and placed in the desired position without undue strain. Heavy frames and bay windows can be lifted quickly to where they are wanted.

Without a derrick the carpenter cannot tender on mill construction. This type of construction which is rapidly gaining favor, for its slow-burning and economical features, is too heavy to handle without lifting equipment.

A one-ton derrick will lift 7 8x8 inches by 12 feet, or 4 10x10 inches by 12 feet, or 3 12x12 inches by 12 feet, or 12x14 inches by 12 feet, without overtaxing it. For handling mill construction two derricks would be found very handy, one to lift the timber from the ground, the other, a lighter one, known as a framing derrick, to place the timber in position. The framing derrick, as shown in Figure 2, has a capacity of 1,800 pounds. It is provided with wheels, so as it can be moved along, as the work proceeds. The illustration shows how nicely it can be used to set the heavy timber on the uprights. It can also be hitched to the uprights and drop them into their places, thus great speed can be made. Many other uses of a derrick could be mentioned, but I wish only to show the most general. If a builder provides himself with a

derrick for general work, he will soon find many little money-saving stunts, to which he can put it.

The old-fashioned block and tackle, may have been all right in the slow-moving past and the almost relegated "Jinni" wheel no doubt served its purpose, when labor presented no problems, but to-day, labor is "king." If an established builder cannot afford labor-saving devices, he cannot afford labor which he can save.

The foregoing treats with derricks in a general way. No particular make was considered. The various makers are always ready and anxious to quote prices, and terms. Different derricks have their particular features, so the builder must choose that one which appeals to him, as embodying the features which will give him the best service.

Treatment of Boiler Water for Industrial Plants

Coal Economy Demands Scale Prevention—Method Must Be Adapted to the Water—Boiler Compounds Rarely Useful

Treatment of feed water for railway and industrial boilers, to prevent the formation of scale, has an important influence upon the efficiency of the boiler and the economy of its service, as is shown in a paper on "Present Tendencies in Water Purification," presented before the Missouri Association of Public Utilities by W. F. Monfort, consulting chemist, St. Louis, Mo. In too many cases steam users use raw water without consideration of its quality, or depend upon certain trade compounds, instead of having analyses made and the treatment problem studied with proper relation to the kind of water that is being used.

It is pointed out that the larger railway systems have found it advantageous to install water-treatment plants. Many industrial enterprises also use softeners regularly, and find economy in installations which take the strain off the boilers, save coal at war prices and maintain expensive plants at high efficiency when labor and material are at a premium, as well as under the old conditions. But a larger number of small and medium-sized water and light plants continue to use water without treatment.

"Recourse to boiler compounds," says Mr. Monfort, "is had sometimes intermittently, quite like that to patent medicines, and there is lack of serious consideration of effects immediately following the use of ill considered remedies which can be applied to boilers. The adequate treatment of a boiler feed water should be based on a complete analysis of the water, should take place outside the boiler and should be tested by its results."

That the analysis should be thorough is indicated by the variety of troubles with feed waters due to silica, sulphates, calcium and magnesium, bicarbonates, sodium and potassium, nitrates, iron, manganese and chlorides. Silica in some waters causes an abundant hard scale. Its treatment calls for special methods. Sulphates in conjunction with calcium yield on evaporation a hard scale of calcium sulphate in some parts of the boiler. The common treatment is addition of soda ash. If this is added to the feed water there may be a high concentration of sodium compounds in the boiler, along with precipitated calcium carbonate, which combination is favorable to wet steam, waste of packing and gaskets, and other ills. Even with pre-treatment foaming may follow.

The treatment must be adapted to the individual supply, which is one reason for its neglect, but at present prices of coal the treatment of feed water is prac-

tically an economic necessity. With well supplies of practically constant composition, the maintenance of a softening plant offers little difficulty. With surface supplies, some additional supervision is required, but first cost and operating cost should be more than offset by boiler economies.

Conditions of three kinds of water before and after treatment are shown in the accompanying table. The

CHARACTER OF RAW AND TREATED WATER FOR BOILERS

Dissolved Solids		Cal- cium	Magne- sium	Sod- ium	Bicar- bonate	Car- bonate	Sul- phate	Chlo- ride
1 { 523	Raw	6.56	2.63	0.02	4.00	0.0	4.38	0.84
1 { 401	Soda lime	1.2	0.1	5.22	0.0	1.3	4.38	8.84
1 { 99	Alternate	1.0	0.0	0.84	0.0	1.0	0.00	0.84
2 { 162	Raw	3.5	2.9	1.3	7.8	0.0	0.65	0.1
2 { 121	Lime-acid	0.6	0.0	1.3	0.0	0.6	1.20	0.1
3 { 277	Raw	2.6	1.33	1.56	2.91	0.0	2.16	0.34
3 { 222	Soda-lime	0.9	0.1	2.50	0.0	1.0	2.16	0.34
3 { 158	Alternate	0.9	0.1	1.66	0.0	1.0	1.23	0.34

first was high in calcium and sulphates, forming hard scale, but low in other constituents when treated. With soda ash and lime, the sodium content was increased and foaming resulted. When treated with lime, soda ash and a barium compound, it became a good, soft water, containing little more than 1 lb. of dissolved matter per 1000 gal. and causing neither hard scale nor foaming.

Calcium and magnesium in waters of high bicarbonate content yield a soft scale, abundant and wasteful of heat. It is difficult to prevent pitting and corrosion of rivets, seams and plates when the deposited soft scale interferes with the quick transmission of heat. Great economy results if this scale is precipitated and collected before the feed water is introduced into the boiler. Corrosion is promoted by the deposit of those magnesium salts which decompose with the liberation of acids (magnesium, chloride, sulphate, nitrate) and such excesses of carbonic acid as are frequent in many of our local waters.

Another type of water, common in parts of Illinois, is represented by No. 2 in the accompanying table, which shows the condition before and after treatment with lime and sulphuric acid. The softened water in actual practice is very desirable for boiler use, forming no scale and giving no cause for corrosion. The other water in the table, No. 3, is an average sample from the Missouri River, near its mouth. The results of two kinds of treatment are indicated.

The cost of treatment is given as follows: For water No. 1, soda-lime, 3.42c per 1000 gal.; alternate, 15.38c; for No. 2, lime-sulphuric acid, 1.09c; for No. 3, soda-lime, 0.89c; alternate, 4.27c. The costs given are based on prices before the war. Present costs are uncertain, says Mr. Monfort, because of the downward tendency which should appear soon. Even allowing for lime at twice the former price, and with soda ash at the double price, and other reagents at current prices, the cost would not be more than doubled. There is still room for economy with the present prices for coal.

The Opportunity of the Small Quarry

One period in the development of man is called the Stone Age, at which time fragments of rock were used to make cumbersome, but rather effective, mauls for cracking heads; later peoples used larger amounts of stone in various forms to build houses, temples and tombs, and adopted somewhat more convenient methods of exterminating the unfriendly; today the use of stone is much more extensive and single American quarries have been crushing and marketing annually heaps of stone that would shame in size the most stupendous pyramid or sacred temple of the ancients.

Crushed stone in one form or another is an impor-

tant part of practically every class of buildings and public improvements. It is required in the construction and repair of streets, roads, railroads, wharves, factories and buildings. The art of quarrying and preparing the stone has been highly developed and millions of tons of crushed stone are hauled annually by the railroads to meet the already large and ever-increasing demand.

The present car shortage will probably interfere with the shipment of stone for various purposes for some time, and many contractors have already suspended operations on road building and repair, bridge approaches and other work that should be pushed to rapid completion, because of the limited amount of broken stone available. Many of these contractors



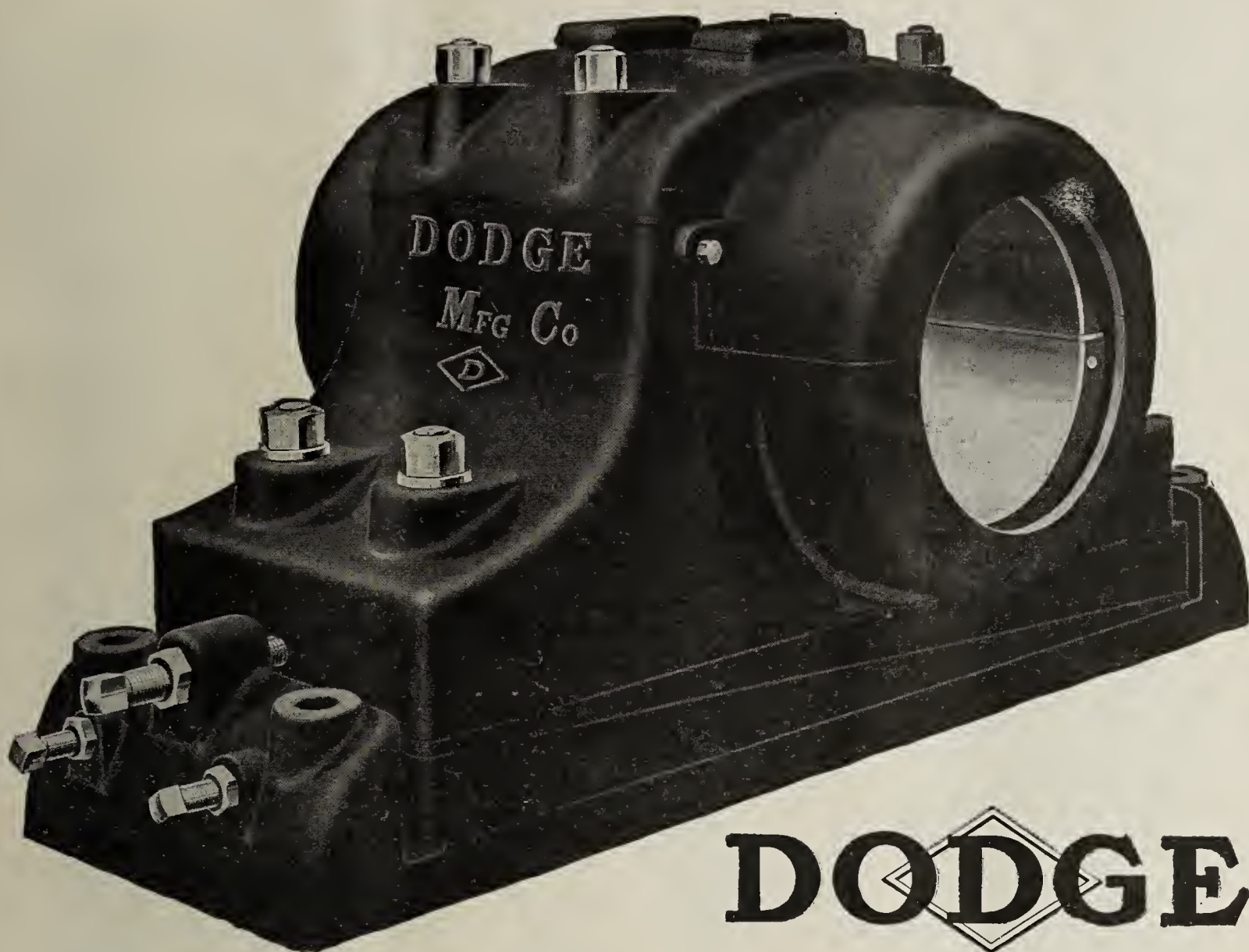
Drilling Operations Showing How One of the No. 2 Outfits Mounted on a Horse-Drawn Truck Is Being Used. This Contractor Is Drilling Rock and Blasting on Road Work.

have in the past depended on stone shipped considerable distances.

In the immediate neighborhood of the work, large amounts of suitable stone are frequently to be found, and the possibilities of opening small quarries or utilizing masses of boulders are left undeveloped. In some case this stone is a good, or better than the stone specified for the job. The reason for this neglect has been because of the greater economy and convenience in handling stone from the larger crushing plants. At this time of limited shipping, small portable crushers can be used in the working of the nearby and readily available stone to the best advantage. The distances are so small that teams and trucks can be used in delivering the stone so that the jobs can be completed and others begun without delay.

When small local quarries are nearby they can in many instances be depended on for immediate delivery of small orders and can be rapidly enlarged to meet the full requirements of the job. In other cases it will be necessary to develop entirely new faces, but, if the work is undertaken in time, they can be made to yield a sufficiency of stone with a minimum of delay and overhead cost.

There is more need of improving our roads than ever before. In time of war road maintenance is an essential part of our system of national defense which cannot be deferred. In the light of the present car



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A pillow block that meets every requirement for extra heavy service.

These pillow blocks support large shafts with heavy equipment and stand up under the strain of heavy, violently fluctuating loads. They're right in design and material and workmanship.

Rings driven through the oil chamber by friction of their own weight upon the shaft apply the oil to the top of the shaft where there is no pressure. All excess oil is automatically returned to the oil chamber which is large

enough to hold a six months supply.

The bearing metal is plastic. It conforms to the shape of the shaft. It is hard and smooth and has the best possible anti-friction qualities.

Each pillow block is mounted on specially made adjustable base plates.

Special equipment and long experience enable us to make these massive pillow blocks accurate to the thousandth part of an inch.

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shortage the supplying of crushed stone for road building is distinctly up to the small, local quarry.

Rock drilling at one-tenth cost can be done by the portable air drill shown in the cut herewith. Cement & Engineering News, 22 Quincy St., Chicago, will gladly send any of its readers a circular concerning this machine.

News of the Cement Plants

The Lehigh Portland Cement Company's plant at Mitchell, Ind., is just now breaking some records in the matter of producing cement and shipping it.

Loading and shipping fifty car loads a day is an ordinary occurrence. Last Friday and Saturday they loaded 120 cars. The demand for cement has been good for some time but the trouble has been in getting cars. However, there is now a good supply of cars, this is said to be due to the steel strike. The shutting down of the steel mills has allowed cars to be used for other purposes. The steel strike has been a good thing for Mitchell, but it won't do to carry it too far for eventually it will react and the building that will be stopped by the steel strike will in a short time affect the cement industry as well as all other kinds of business.

The Petoskey Portland Cement Company, Petoskey, Mich., recently incorporated, capital stock \$1,500,000. They expect to start building an up-to-date cement plant in the near future.

President P. M. Jewett and Secretary C. W. Crouse of the Diamond Portland Cement Company, Phoenix, Ariz., will make a proposition to the Maricopa County highway commissioners to supply them cement of standard quality at a price not exceeding \$2.75 a barrel, or 70 cents per sack for the consideration of an advance of \$50,000 to be used in rehabilitating the old cement plant.

The officials of the cement plant issued the following statement: "We have faith that the people, through the Water Users' Association, will see to it that the necessary power is furnished at a reasonable cost. Judging from a thorough investigation and report of Engineer Duryea and other efficient engineers, who know the condition of our machinery and the quality of the material, we are sure that cement of the highest grade can be made here at a great profit both to the manufacturers and the cement users. It will mean that one-half of the cost of manufacture will remain in circulation in Phoenix, including those who appear to be disposed to assist the cement trust."

News of the Sand and Gravel Pits

The Lincoln Sand & Gravel Pit, Lincoln, Ill., hit it up the last month for the best month's business in their history. Moving the screen and reducing the pumping distance for the output makes it possible to load 50 cars a day if the cars can be had. This means two big solid trains of gravel each and every day. The men now work on a bonus plan, getting a bonus of a certain sum per car for every car over a stipulated number produced. The first day's run with the new plant netted 52 cars of gravel, the largest day's output.

The gravel plants operated by Logan County, Ill., are busy. That at New Holland is in full blast, and will furnish enough gravel to complete the graveling of the Lincoln to New Holland road on Route No. 13 before winter.

The Salt Creek gravel plant is supplying gravel for

the road between Mt. Pulaski and Chester township line, east to Chestnut.

A gravel testing gang, in charge of Charles Buchanan, is out developing new pits along routes which it is planned to improve. Two especially fine banks on railroads, worthy of commercial development, have been located.

Robert Rieben was killed in a cave-in at the pit of the Waupaca Sand & Gravel Co., Waupaca, Wis. Another workman was buried, but was rescued. The first cave-in carried the men into the pit and a second followed, covering Mr. Rieben to such a depth that it took an hour and a half to recover his body.

A diver is being used in connection with their derrick boat, by the Evansville Sand & Gravel Co., Evansville, Ind., in raising the sunken gravel digger near the traction incline, and they expect to finish this week and be here next week.

The water is very low and some doubt is expressed about being able to get down the river with a full barge load, however the prospects for securing gravel about the first of next week are good.

The county can put about ten trucks, hauling on the Air Line road and to Geneva, to finish roads already started, which will require about 3,000 yards more this year.

A new side dump body, made by the International Steel & Iron Co., at Evansville, for the county army truck, has been received. It was made on the design suggested by Judge Farmer, and worked out by the county road engineer.

Building In New Zealand

Auckland, N. Z., October 25.—Buildings are being constructed in New Zealand not according to tender contract but on a percentage basis, reports the Vice-Consul at Auckland; that is, the contractor agrees to put up the building for whatever the material and labor cost him plus a certain percentage, which is his commission. Builders do not care to tender at contract prices while labor and wages are so unsteady and cost of materials, especially imported builders' supplies, fluctuates so greatly. Construction work continues to boom throughout New Zealand, although it is somewhat handicapped by the present coal shortage, as the Government has prohibited the carrying of building materials on the railways during the coal crisis.

Opens Detroit Office

The Jeffrey Manufacturing Company, Columbus, Ohio, announces that owing to the constantly increasing demand for Jeffrey products in the Detroit district, they have opened a new branch office in Detroit in the Book Building on Washington Street, between State and Grand Avenues.

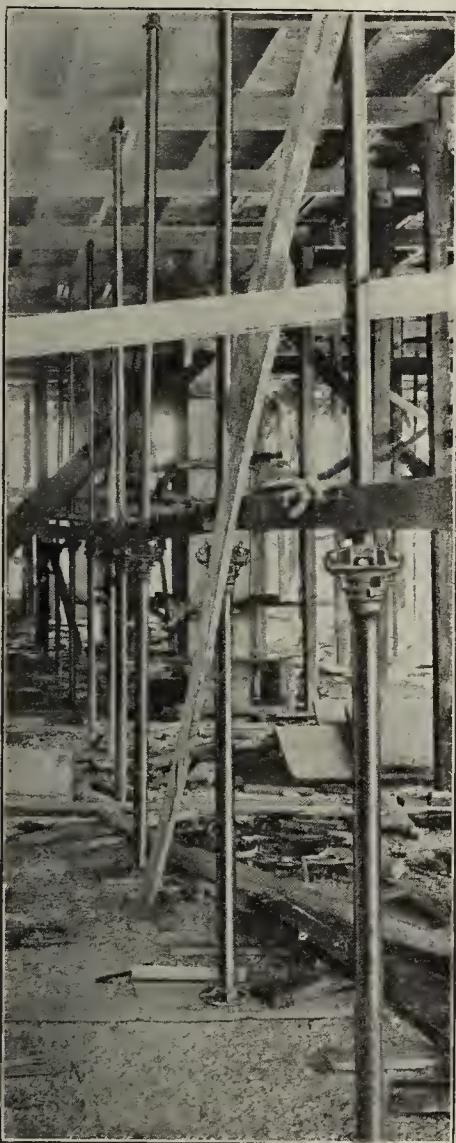
This office will be in charge of Mr. O. B. Wescott, who has had long and successful engineering experience in the Sales and Engineering-Construction Department of their company and is well equipped to render valuable assistance to clients in working out the most economical and practical material-handling equipments for their requirements.

Mr. Wescott will give personal attention to inquiries for Jeffrey Portable Loading, Elevating, Conveying, Crushing, Pulverizing, Screening or Tipple Machinery, and will welcome the opportunity of serving their customers in Detroit and vicinity.

Mr. Contractor:

Jiffy Labor-Savers Make Money for You

Wood shoring costs approximately $3\frac{1}{2}$ cents per square foot of floor area. **JIFFY ADJUSTABLE JACKS** easily do the same work—and do it better—for *less than 1 cent per square foot*. This saving will help secure contracts.



Jiffy Jacks are here shown making money for Fred Drew, Inc., Woodward Bldg., Washington, D. C., on the Kennedy Apartments. Jacks are set full height under 14-inch floor slab.

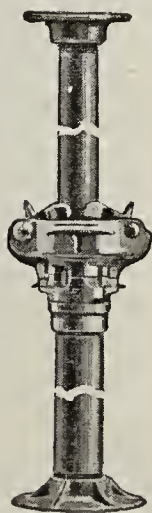


Jiffy Double Head Jack for flat slab work.

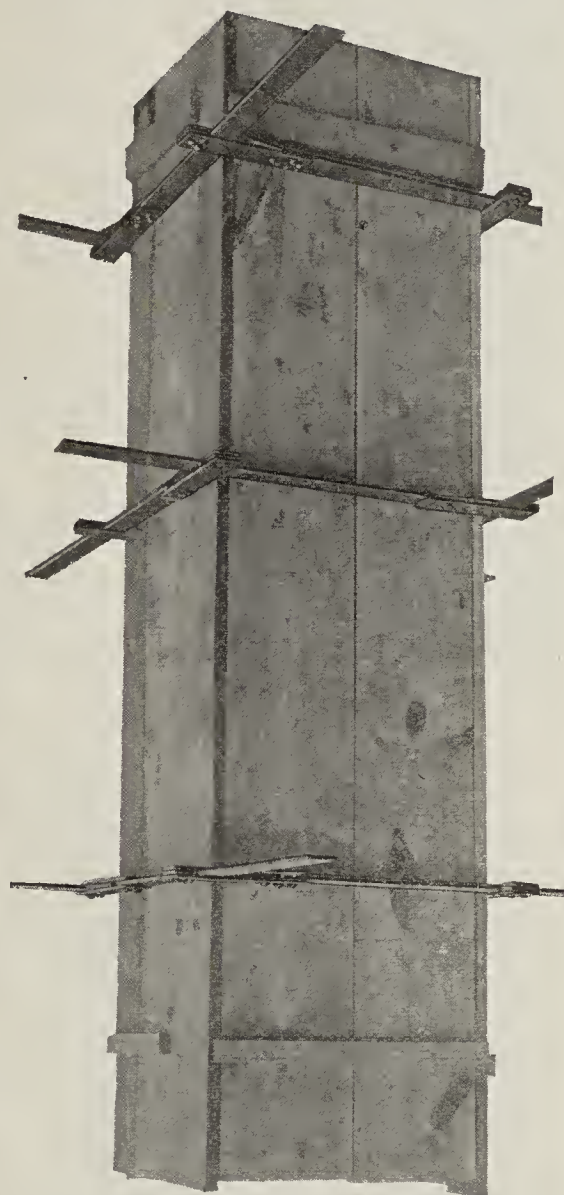


Jiffy Deep Joist Jack keeps a deep joist from canting.

Jiffy Jack
Brace
Clamps
Jiffy Trench
Jacks
Jiffy Scaffold
Hangers
and Other
Concrete
Appliances



Jiffy Panel Jack for temporary work or reshoring.



JIFFY Column Clamp Also Means Bigger Profits

Simplest and quickest to set. Requires no wedging. No dead space in its adjustment. Automatically squares column. Positively closes all cracks. Also made for round columns. No small parts to get lost.

WRITE FOR FACTS AND PRICES

Paul W. Koch & Company, Lees Bldg., Chicago

"Fairmount" Rock Crusher

The Allis-Chalmers Manufacturing Co., Milwaukee, Wis., is circulating an 18-page booklet, Bulletin No. 1456, which is devoted to the presentation of the Fairmount type crusher. These are produced in sizes from 24x60 in. to 60x84 in. The bulletin features these crushers as especially favorable to a large receiving opening, with forcible mechanical discharge, and a roll crushing action such as to reduce the percentage of fines. The machine is well illustrated and described. Below is a partial list of users of Fairmount crushers.

Casparis Stone Company. (Two machines.)
 Canada Cement Co., Ltd. (Four machines.)
 Olympic Portland Cement Company.
 Eric Stone Company.
 Portage Silica Company.
 Atlas Portland Cement Company. (Two machines.)
 LaSalle Cement Company.
 Lawrence Portland Cement Company.
 Iola Portland Cement Company.
 Dexter Portland Cement Company.
 Great Lakes Stone & Lime Company. (Two machines.)
 Vulcanite Portland Cement Company.
 Southwestern Portland Cement Company.
 Whitehall Cement Manufacturing Company.
 United States Portland Cement Company.
 Basic Products Company.
 Nebraska Cement Company.
 Ash Grove Lime & Portland Cement Company.
 Old Mission Portland Cement Company.
 Olive Hill Limestone Company.
 Michigan Alkali Company.
 Asano Cement Company.
 Metropolitan Brick Co.
 Santa Cruz Portland Cement Co.

Oregon Cement Mills

The big Portland cement plant on the west bank of the Willamette River is in full operation manufacturing the famous Oregon building product.

The capacity of the plant is 1,100 barrels, or 4,400 sacks daily, requiring the services of 55 men and two women. One woman operates the machine which ties the empty bags.

The quarries are located at Dallas, in Polk county, where cement rock is obtained, and at Roseburg, where lime is procured. Eighty or more men are employed at the two quarries.

Eight carloads of raw material are unloaded at the Oswego factory daily, while between seven and ten carloads of the finished product are shipped out, the latter representing anywhere from 175 to 310 barrels, or 30 to 60 tons to each car. The company's freight bill paid to the Southern Pacific Company for July totalled \$10,416.80.

Six thousand barrels are being sent by water to St. Johns to be used in finishing the terminal.

Clark M. Moore Now With International Cement Co.

Clark Moore, 1030 Grant street, Denver, Colo., has arrived at the top rung of the cement ladder.

Announcement has just been made of the appointment of Mr. Moore, who is known to almost every man in the lumber and cement business in the inter-mountain country, to the position of assistant to the president of the International Portland Cement Company. And as soon as he finishes a few months' work for the com-

pany in South America he will return to New York City as general manager of all the interests of the company, both in this country and abroad.

Mr. Moore will retain his interest in the Moore Lumber Company of Denver, in which he is associated with his brother, J. E. Moore.

For the last nine years Mr. Moore has been general sales manager for the Cement Security Company. To him is due a great deal of the credit for building up the cement business in Colorado. He is one of the twelve directors in the United States of the National Portland Cement Association.

Before becoming associated with the Cement Securities Company Mr. Moore for several years was with the McPhee & McGinnity Company of Denver. He is a member of the Denver Athletic Club, the Civic and Commercial Association and of the Oklahoma City Chamber of Commerce.

He is now in South America, where he will look after the Portland Cement Company's interests in Montevideo and Buenos Aires. He will be in South America for eight or ten months.

Austin's New Catalog

Austin Manufacturing Co., Chicago, in its new catalog, No. 28, has supplied a text book on gyratory crushers and other quarry equipment for the man lacking engineering training. It is also one of the most complete catalogs of the kind. Diagrams, photographs and text help to an understanding of all parts of the machine. Other equipment shown in picture and text are elevators, screens, hoists, portable bins, dump cars, spouts and road machinery. A number of pages show plans from which plants have been constructed which are interesting and suggestive.



**THE ONLY
SCREW HOLES
IN THE WORLD**

You drive the screw holes with a hammer in any material.
 The screw holes are made for wood screws or machine screws to fit all sizes of screws. The head is removed and you leave a permanent screw hole.

The Stine Screw Holes Co.
 Manufacturers
 WATERBURY, CONN., U. S. A.
 DEPARTMENT 9

Once a Screw Hole, Always a Screw Hole

The Biggest Little Thing in the World

Some of the Reasons Why Screw Holes Will Be Bought and Used and Not Become Dead Stock for Anyone

- 1—They can be used without damage to receiving material.
- 2—They enable you to standardize to wood or machine screws in all material.
- 3—They are made of brass and will not rust under atmospheric or moisture conditions.
- 4—ECONOMY—They save more time value than the holes cost.
- 5—You get them for nothing and are paid for using them when you count time saved.
- 6—Screw holes have been needed ever since the first screw was used.
- 7—Special tools are NOT needed in using them in any material.
- 8—They can be used in any place a screw can be used.
- 9—By using screw holes, screws can be used in many places, and in many materials where it is impossible to use screws without them.
- 10—These are the only ready-made screw holes in the world.
- 11—No special screws are needed. These screw holes fit any wood screw or machine screw now in stock.
- 12—They make the neatest possible job in any material.
- 13—Every store where screws are sold must carry them in stock, because the line of screws is not complete without screw holes for them.
- 14—Every shop and factory where screws are used must also have these screw holes to fit the screws.
- 15—They are endorsed by all dealers in screws and by all users of screws.
- 16—Screw holes are entirely new and the world supply is yet to be furnished.
- 17—This is a progressive Old World of ours; and every active person in it must adopt all improved methods, and all new articles that will help him keep in the front line of progress.
- 18—Be among the first to stock up in screw holes if you are a dealer in screws.
- 19—Be among the first to install screw holes in your shop or factory, as you begin to save money soon as you use them.
- 20—In spite of the high cost of brass, screw holes are yet cheap.
- 21—We are letting the world know that screw holes can now be secured, by means of extensive advertising in all the principal Trade Journals that have the largest circulation among dealers in screws as well as users of screws.
- 22—Do not let your customer ask you for screw holes before you have them in stock. BE A LIVE WIRE.
- 23—They make everlasting holes in any material.
- 24—They mean "Plug-No-More" screw holes.
- 25—They are the result of Necessity being The Mother of Invention.
- 26—Anyone who can drive a nail can use screw holes.
- 27—Send for a sample and convince yourself.
- 28—Mechanics who see them say, "What do you think of that?"
- 29—In fact there are NO REASONS why screw holes should NOT be used.

Each of these reasons are enough to sell Screw Holes. There are many other reasons.
 Write at once for our handsome Color Card showing screw holes in various materials which will be sent on request, together with samples and price list.

Big Money In Silo Building—We Start and Back You

Farmers have ready money—they will build more silos this year than ever—now is the time to get started in this profitable business. We give you some genuine assistance in manufacturing, help you sell, even aid you build the first silo or two. No experience is needed—the first two silos pay for entire equipment.

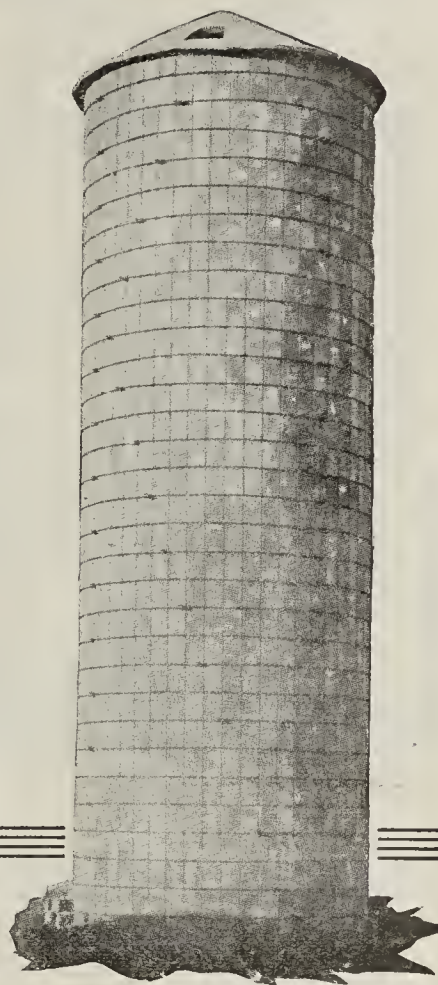
Experienced Silo Builders, Enlist Our Aid

The more you know about the silo business the more you will appreciate the value, quality and service we give with our silo machines, equipment and hardware. And more—we help you sell more silos—extend every legitimate effort toward making your business more profitable.



Valuable Facts—Free

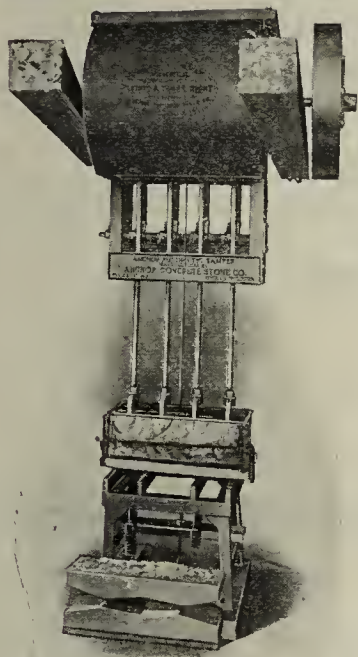
For the asking you may have figures on the cost of production and construction—selling prices based on various profits—and complete catalog. Ask to-day.



New Monarch Mach. & Stamping Co.

S. W. 9th and Murphy Sts.

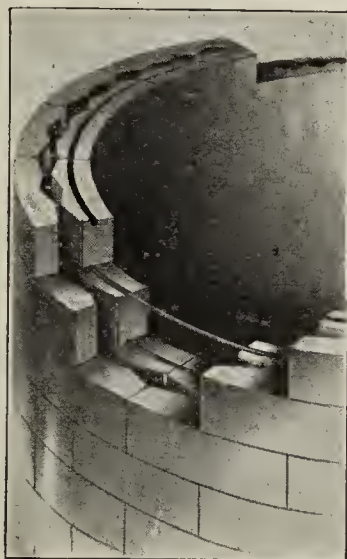
Des Moines, Ia.



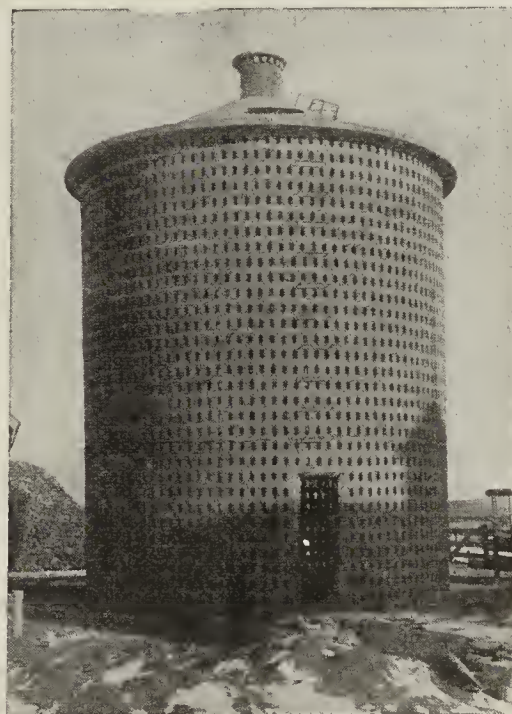
Anchor Tamper over Anchor 24" Building Block Machine

One Anchor Block Machine with a few attachments makes all of the above types of blocks and several others. The same Anchor Tamper tamps them all. Any block with cement connections will conduct frost and moisture. The Anchor Block will not.

ANCHOR



Anchor Continuous Air Space Silos Are Frost and Moisture Proof



Anchor Ventilated Corn Crib. Two Blocks made each operation. Each Block 24"x4"x8"

ANCHOR AUTOMATIC TAMPERS

are built to operate over any make of BLOCK, BRICK, or SILO STAVE Machine. Guaranteed to give satisfaction. This tamper seldom, if ever, needs repairs. We justify this claim by guaranteeing to furnish all repairs for THREE YEARS absolutely FREE.

For catalog describing our Block Machinery, Tampers, All Steel Silo Doors, Silo Scaffolds, etc. Write

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THE 300,000 HP. ELECTRIC CITY

MIXERS — PAVERS — GROUTERS
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"WHITE SEAL"

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BECAUSE WE SPECIALIZE ON

Lock Seam Pipe with the smooth
inside surface,
having already

furnished large quantities for Potash Recovery plants, we
are able to give especially careful attention to the construc-
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MR. QUARRY OWNER—HAVE YOU A QUARRY AND
rock crushing plant that is fully equipped with up-to-date
machinery, having transportation and plenty of rock resources
and man power, yet you know that production is not satisfac-
tory? Why not consider my proposition as expert efficiency
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production to maximum capacity. Address A. Anthony, 812
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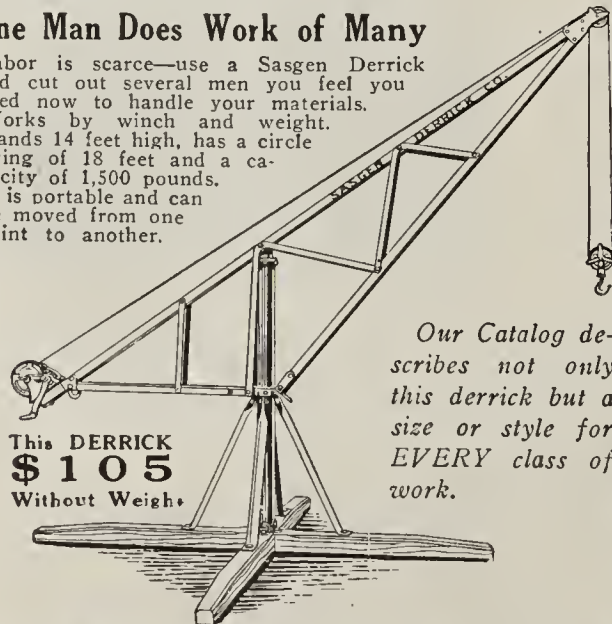
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The Sasgen Circle Swing Counterweight Derrick
cuts costs, labor and time loading or unloading
material from cars or wagons.

One Man Does Work of Many

Labor is scarce—use a Sasgen Derrick
and cut out several men you feel you
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Works by winch and weight.
Stands 14 feet high, has a circle
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be moved from one
point to another.



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EVERY class of
work.

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High Grade Goods Only**

Satisfaction Guaranteed

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A series of 1-story buildings, all directly connected,
including boiler and engine room, drying and grinding
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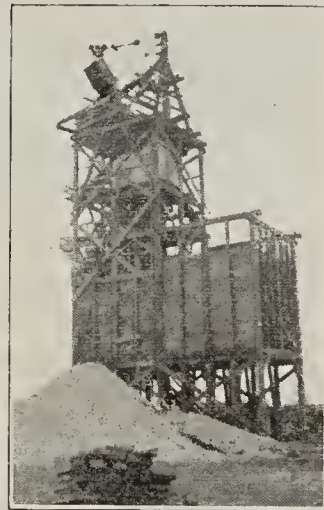
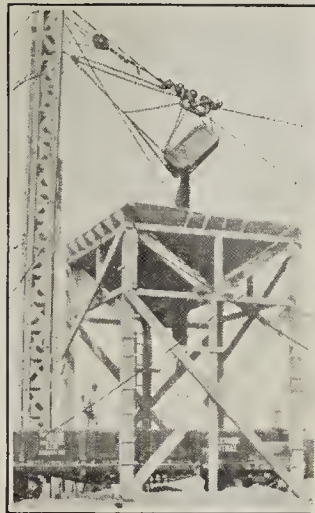
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BARS CUT TO LENGTH
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CONCRETE STEEL COMPANY

MONADNOCK BLOCK
CHICAGO

How to Simplify Excavating and Conveying of Materials



IF you have work involving excavating material and conveying a distance of 300 to 700 ft., why not use a one-man excavator that will not only dig, but also lift and convey the material to the desired point and dump it into bins, hoppers, cars, piles or embankments? Thus you can do away with an intermediate conveying system and decrease your labor, machinery and up-keep cost.

SAUERMAN DRAGLINE CABLEWAY EXCAVATORS

have been successfully installed for the following classes of work: Excavating sand and gravel from wet or dry pit; loading ballast; reclaiming ore from stock piles; reclaiming coal from storage; backfilling retaining walls; deepening rivers; building levees; building earth dams; stripping clay beds; cleaning reservoirs.

Have you an excavating problem to solve? If so, the experience of our engineers in planning hundreds of installations of our machines is at your service.

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Cable Excavators—Power Scrapers—Cableway Accessories.



"Stonekote" residence at Hinsdale, Ill.

"Stonekote" Rough Cast

The only cement plaster for all exterior surfaces—rough cast, float coat, trowel finish, or polish finish. As hard as natural stone; made in any non-fading color desired. Stonekote is shipped as a dry material; any mechanic can mix and apply. It is the only perfect waterproof and wear-resisting plastic finish to give permanent and delightful results.

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Save more than
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In these days it isn't entirely a question of how much it will cost to replace worn-out equipment. It's more a question of whether or not you can get new equipment at all. It's therefore doubly essential that you take proper care of those machines you are now fortunate enough to have.

Plain and waterproof covers for all purposes. New and second-hand tents for sale or rent.

United States Tent & Awning Co.
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THE POLK SYSTEM

All-Steel Machines for All Kinds of

Circular Concrete Construction

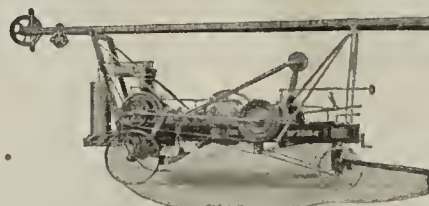
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**The Cyclone
No. 14**

Heavy, solidly braced frame — Sill timbers 4" x 14". All machinery placed directly on the main sills protecting it against strains and preventing top heaviness. **Eighty per cent (80%) of the castings are cast steel—not cast iron.** The Cyclone No. 14 is the only Blast-Hole drill so built. Furnished in Steam, Gasoline, Compressed Air or Electric Power; traction or non-traction.

The Sanderson Cyclone Drill Co., Orrville, Ohio
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Three grades: open hearth steel (new billet stock), "medium" and "hard" grade, and rail carbon steel (re-rolled). Both theory and practice agree on the design. Rounded corners prevent splitting of the concrete. Bending, fabricating and setting are easily done with these bars.

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Laclede Bars for Reinforcing Concrete



Many buyers now take advantage of facilities at mill by ordering bars cut to length, bent to shape, and tagged—ready for placing.



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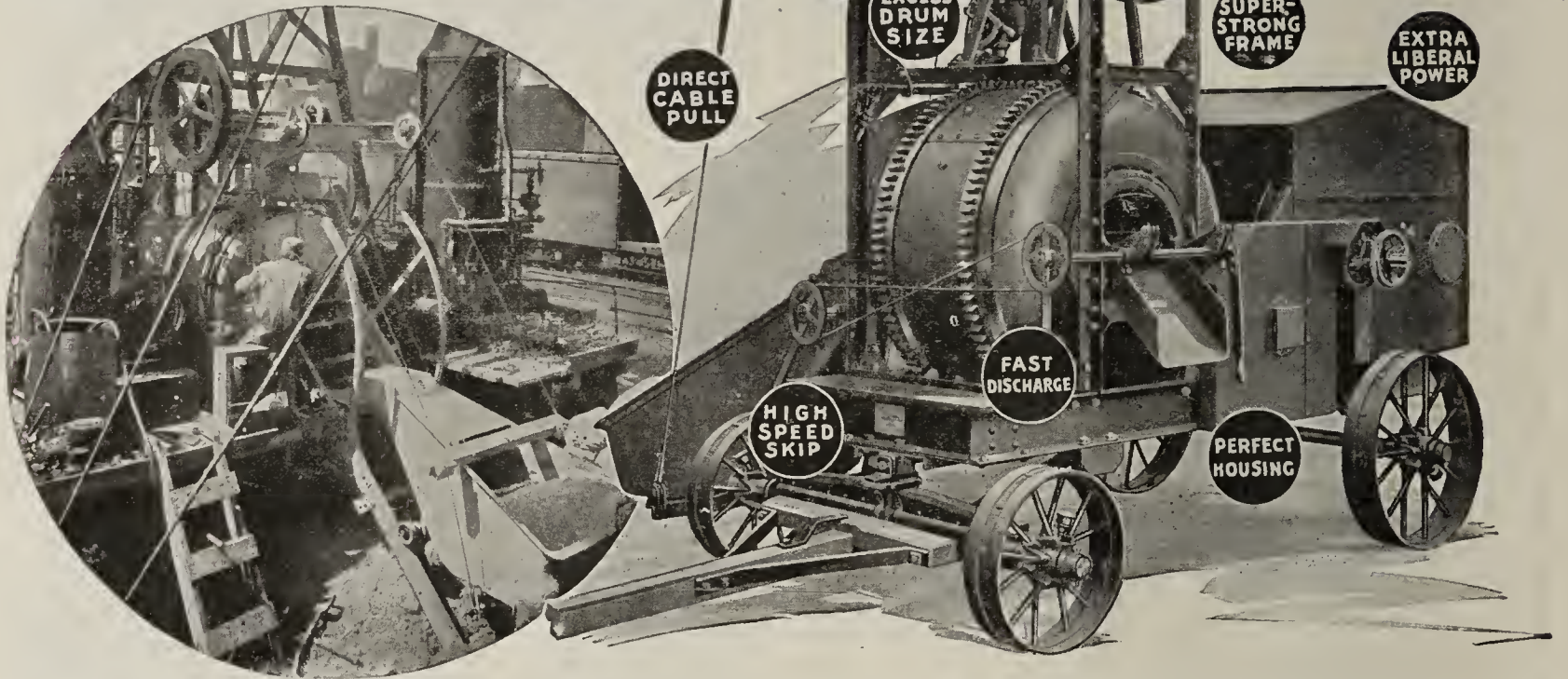
all weights and sections

Also Spikes, Bolts and
Accessories

Punchings for Cement Crushing

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HEAVY DUTY MIXER



THE surest-profit factor you can bring on a job—mixer dependability in the form of Koehring heavy duty construction.

Koehring-mixed concrete is **Dominant Strength** concrete, so established by official tests whereby Koehring mixed concrete has been proved to be as much as 31% stronger than concrete mixed by other mixers.

Due to the Koehring re-mixing action Koehring-mixed concrete is uniform in

distribution of aggregate to the last shovel-ful of every batch.

Write for Koehring catalog No. B-5—a book that shows in detail Koehring heavy duty construction—shows you how to judge mixer value.

Koehring Capacities

in cu. ft. wet batch rating

Pavers 10, 14, 21 and 28 cubic feet mixed concrete, with or without loading derrick.

Construction Mixers, 7, 10, 14, 21, 28 cu. ft.

Hot Mixers for bituminous work, 9, 14 cu. ft. side charging type; 18 cu. ft. paver type.

Gasoline, Steam and Electric Power.

DANDIE LIGHT MIXER



Koehring Dandie Light Mixer—4 and 7 cu. ft. capacity, wet batch rating—a light mixer that brings dependability into the light mixer field—at a price that makes it the remarkable value of the industry. The reasonable investment mixer for miscellaneous work on big contracts, for footings, culverts, silos, etc., or for all general work within capacities. No. 104-S, gasoline, No. 107-S, steam and gasoline—may be equipped with standard or batch hopper, low charging platform, or power charging skip, automatic water-measuring tank or light duty hoist. Write for catalog B-45.

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Produce your Sand and Gravel with a Negley excavator.

It digs, conveys and dumps the material at a moderate cost.

Operates on a Slack Cable-Way with a two-drum hoist.

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Facing Concrete Blocks, Ornamental Concrete Stone, Hard Plaster, Finishing, Exterior Plastering, Roofing, Stone and Marble Sawing, etc.

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Cement and Hydrated Lime Plants a Specialty

Reports, Examinations and Analyses of Raw Materials for Cement Consultations Solicited

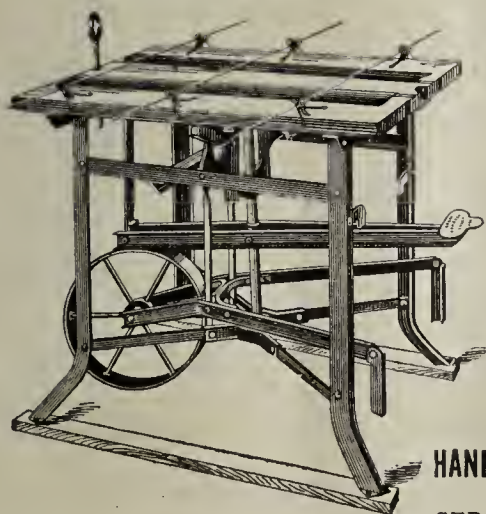
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PURIFICATION SYSTEMS
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FOR BOILER FEED AND
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SAVE CEMENT SACK LOSS

Bale your sacks up tight and right. Keep them baled up all the time. If you have one of our handy sack balers you will do this. We manufacture a cleaner that cleans. Write us for prices and further information.

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- 1—15-20-ton 8-wheel Brownhoist Locomotive Crane, 50-ft. Radius Boom.
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Several Clam Shell Buckets, Various Sizes

- 2—No. "O" Thew Traction Steam Shovel, 3/4-cu. yd. Dipper.
- 1—40-ton Standard Gauge Saddle Tank Baldwin Locomotive.
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ALSO CONSIDERABLE OTHER EQUIPMENT.

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CRUSHERS

- 1—No. 21 Gates Gyratory
- 2—No. 12 Gates Gyratory
- 1—No. 10 Gates Gyratory
- 1—No. 10 Kennedy Gyratory
- 1—No. 9 Gates Gyratory
- 3—No. 8 Gates Gyratory
- 4—No. 7 1/2 Assorted Gyratory
- 6—No. 6 Assorted Gyratory
- 3—No. 5 Assorted Gyratory
- 8—No. 4, 3 and 2 Assorted

PULVERIZERS

- 12—Hammer Pulverizers
- 15—Sets Crushing Rolls
- 35—Griffin Mills
- 8—Ball & Tube Mills
- 2—Symons Disc Crushers
- 15—Kent Mills
- 3—Pebble Mills
- 3—Sturtevant Mills
- 4—Burr Mills
- 3—Raymond Mills

GRINDERS

- 1—60x84 Jaw Crusher
- 10—10x20 to 36x48 In.
- 6—Portable Jaw Plants
- 4—Coal Crushers
- 3—Tipples
- 6—Ore Washers
- 8—Channeling Machines
- Conveyors—Screens
- Stripping and Loading
- Shovels, Cars and Cranes

Locomotives, Cars, Rails, Steam Shovels, Dragline Machines, Dredges, Corliss Engines, Water Tube and Return Tubular Boilers, Turbo Generators, Direct Connected and Belted, also Fuel Oil Direct Connected Sets, Heavy Fuel Oil Engines, Electric Fuel Oil Locomotives, Compressors, Drills, Cutting and Channeling Machines, Stone Derricks, Electric and Steam Hoists.

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1 3 General Elec., type CVC shunt.	
Interpole	1650
1 3 Holtzer-Cabot	1600
2 3 Bartz-Wyand & Brown	1525
2 3 Westinghouse	1500
1 3 Crocker-Wheeler, form L	1437
1 3 Fairbanks-Morse	1400
1 3 National	1100
3 3 Gen. Elec., type CE	1050
1 3 1/2 Westinghouse, MP, type M	950
1 3 1/2 Westinghouse, type SK, comp.	
Interpole, variable speed	375-1500
1 5 Crocker-Wheeler, form L	1850
1 5 Gen. Elec., type CF	1100
16 5 Colonial, comp.	580
2 5 Gen. Elec., type RL, form B.	
shunt, variable speed	500-1500
1 10 Gen. Elec., type RC, comp., in-	
terpole	1150
1 10 Jenney	1060
1 10 Cincinnati	900
1 10 Fisher	850
2 10 Fairbanks-Morse	700
1 10 Crocker-Wheeler, MP, type L.	
variable speed	720-1200
1 10 Gen. Elec., type CO	650
1 12 Western Elec.	1200
2 13 Crocker-Wheeler	1100
1 15 Allis-Chalmers	875
1 15 Jenney	850
1 15 Western Elec.	775
1 15 Gen. Elec.	690
1 15 Gen. Elec.	625
1 15 Triumph	520
2 17 Crocker-Wheeler, MP, type L.	
variable speed	700-1400
1 20 Lincoln	540

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- 50-foot Elevator. Almost new.
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- 3—Switches and all rail laid in quarry.
- Quantity of 20-lb. rail not in use.
- Plant can be seen in operation at any appointed time.

BOX 92

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22 Quincy St. Chicago, Ill.

ARCHITECTS & ENGINEERS HANDBOOK OF REINFORCED CONCRETE

We have a few copies left, of L. J. Mensch's "Architects & Engineers' Handbook of Reinforced Concrete," illustrated, 217 pages, a well known and authoritative work, former price \$2.00; you may now have for \$1.00 each. Send to Cement & Engineering News.

HANDBOOK ON CALCIUM SILICATES AND CALCIUM ALUMINATES IN PORTLAND CEMENT

The Cement Manufacturer, The Cement Chemist, and even those interested in the Cement Industry in a less technical way, should not fail to possess a copy of "The Calcium Silicates and Calcium Aluminates Contained in Portland Cement," by Dr. Otto Schott, a valuable treatise of 100 pages fully illustrated. We have it for sale, price 50 cents; send to Cement & Engineering News.

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The Manufacturer of Lime, or of Gypsum, the Chemists, or the Cement Manufacturer should send for the "Manufacture of Hydraulic Gypsum, and other Gypsum Products" by M. Glascnapp, a clever treatise, by a clever Russian; we have it, translated from the original French, price 50 cents. It is based upon an extensive microscopical research. Shows the excellent properties of some kinds of burnt Gypsum, and describes the various products obtainable by heating and calcining native gypsum. Fully illustrated, about fifty pages. Send to Cement & Engineering News.

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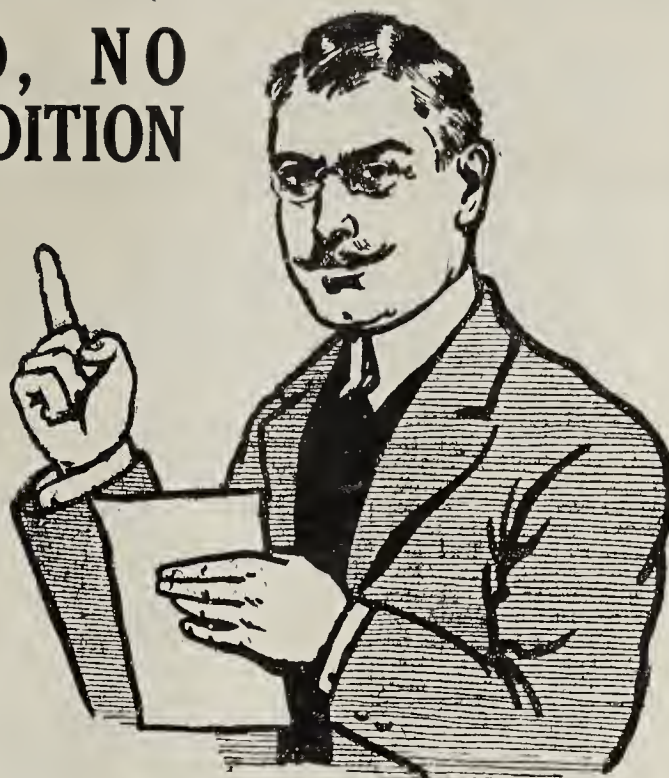
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COMPLETE WITH CHARGE OF BALLS
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For Sale—One brand new 1-yard Page Drag Line bucket, Chain hoist bale, heavy magneese steel cutting edge, carbon steel trunions and two-part magneese steel teeth.

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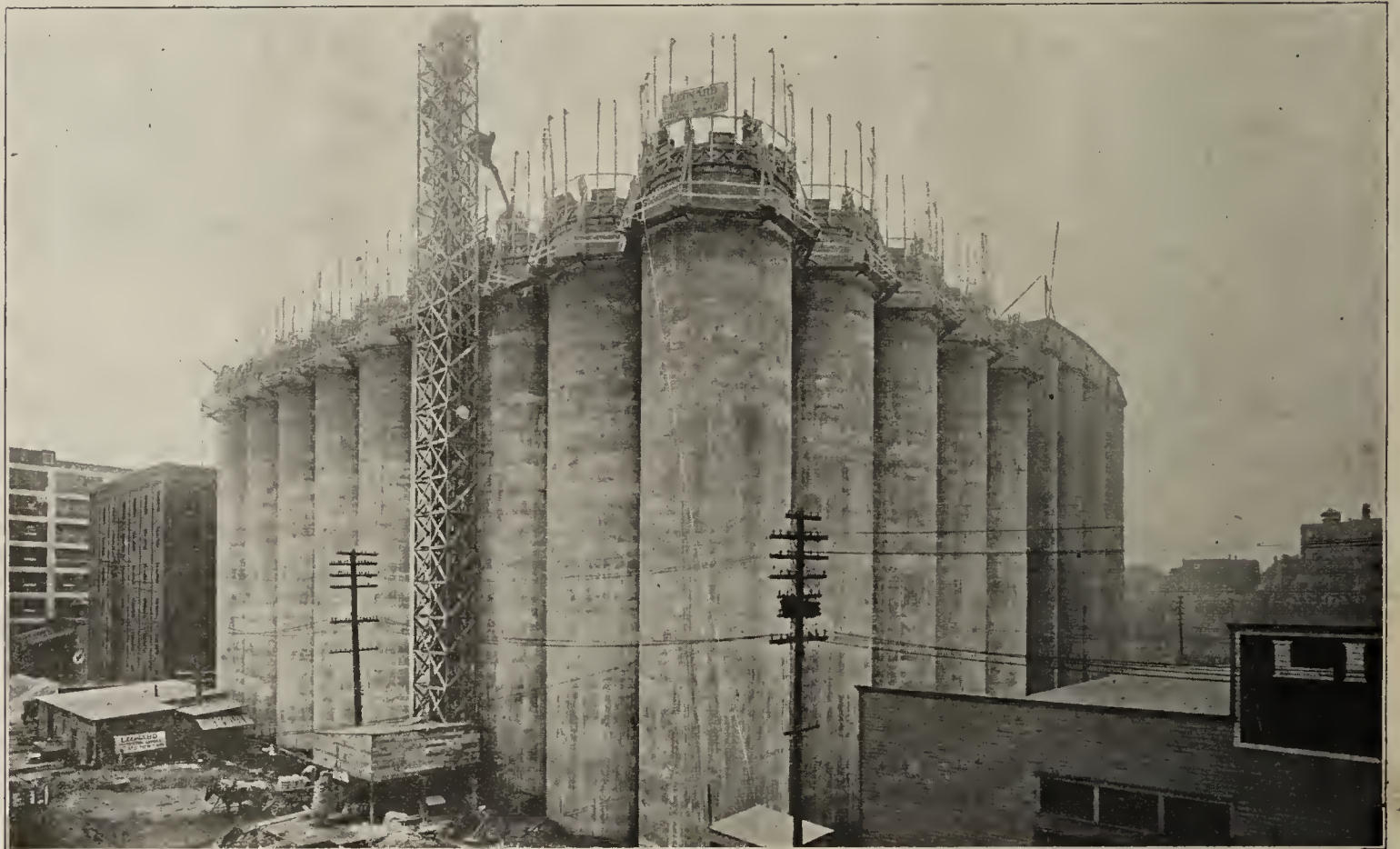
Ross-Gould, 455C N. 9th Street, St. Louis.

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INVESTIGATION AND EXPERIENCE ARE PROVING THE RELIABILITY OF HYDRATED LIME

FOR WATER PROOFING AND TO FACILITATE POURING CONCRETE



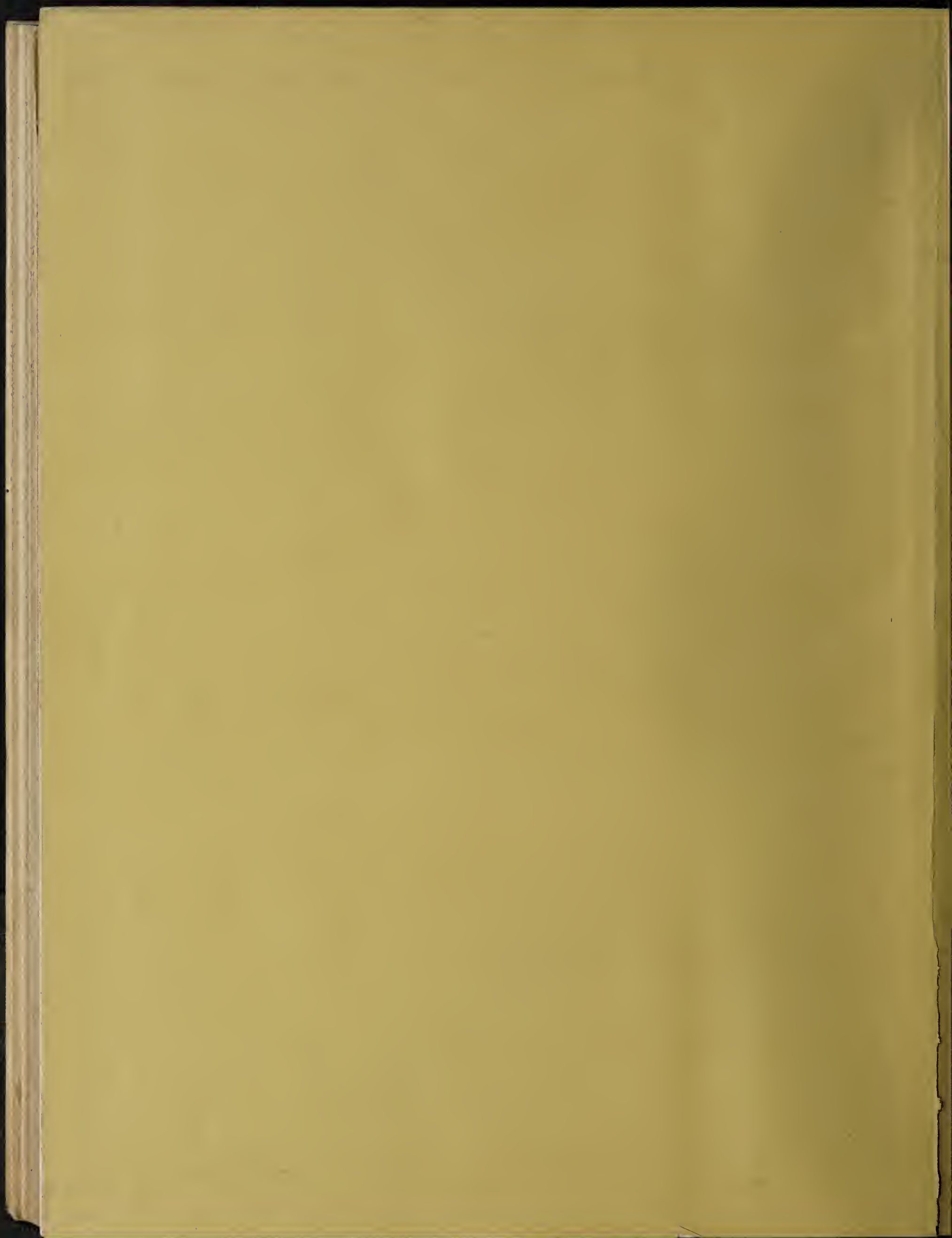
In these 51 concrete storage tanks, recently erected in Cedar Rapids, Iowa, by the Quaker Oats Co., there are approximately 12,500 cubic yards of concrete—1-2-4 mix. The walls are perfect cylinders, with no lips or bulged surfaces.

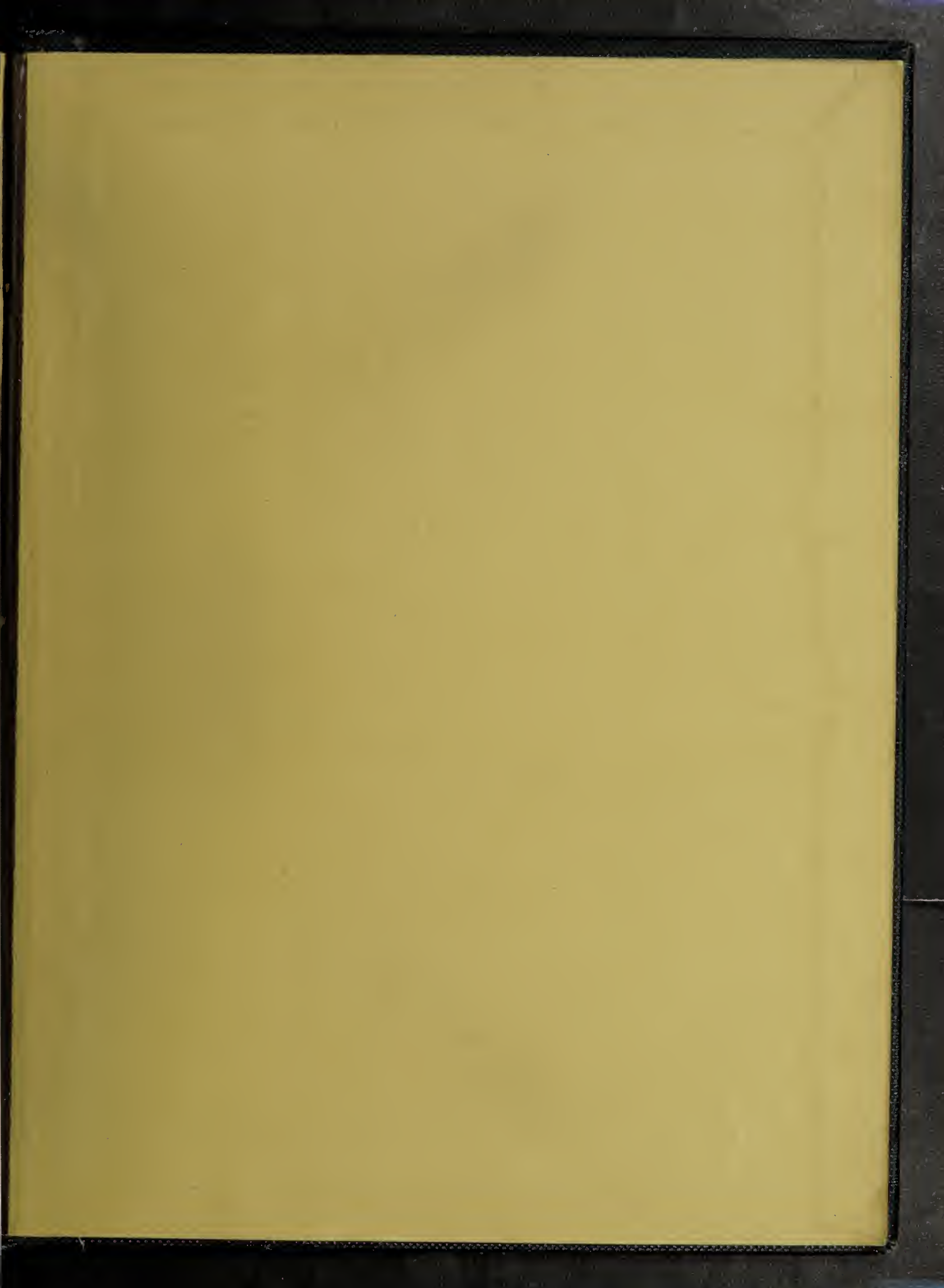
Hydrated lime was used for waterproofing and also to facilitate pouring the concrete and lifting the forms, owing to its lubricating properties. In mixing, 25 pounds of hydrated lime was put into each batch, which made the percentage of lime to cement a little over 8% by weight. The mixers used were of such size that three bags of cement could be used in each batch.

Considerable credit is given by the Leonard Construction Co. of Chicago to the lime. The statement is made that the lime gave the exterior surface a white and uniform appearance, and that the surface needed no subsequent coating. There were no joints where the concrete stuck to the forms and "lifted," as it does in many cases where the concrete is not of uniform mixture.

Write any of the following competing manufacturers of Hydrated Lime for complete information about Hydrated Lime in Concrete

Marblehead Lime Co., Chicago—Kansas City	Ste Genevieve Lime Co., St. Louis, Mo.	Kelley Island Lime & Trans- port Co., Cleveland, Ohio	Woodville Lime Products Co., Toledo, Ohio
Port Byron Lime Assn., Port Byron, Ill.	Palmer Lime & Cement Co., 103 Park Ave., New York, N. Y.	National Lime & Stone Co., Carey, Ohio	Merion Lime & Stone Co., Norristown, Pa.
Lee Lime Co., Lee, Mass.	Rockland & Rockport Lime Co., New York—Rockland, Maine—Boston	Ohio Hydrate & Supply Co., Woodville, Ohio	American Lime & Stone Co., Tyrone, Pa.
White Marble Lime Co., Manistique, Mich.	O. C. Barber Allied Industries Co., Canton, Ohio	John D. Owens & Son Co., Owens, Ohio.	Vermarco Lime Co., West Rutland, Vt.
Glencoe Lime & Cement Co., St. Louis, Mo.	Hunkins-Willis Lime & Cement Co., St. Louis, Mo.	Riverton Lime Co., Riverton, Va.	Union Lime Co., Milwaukee, Wis.





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